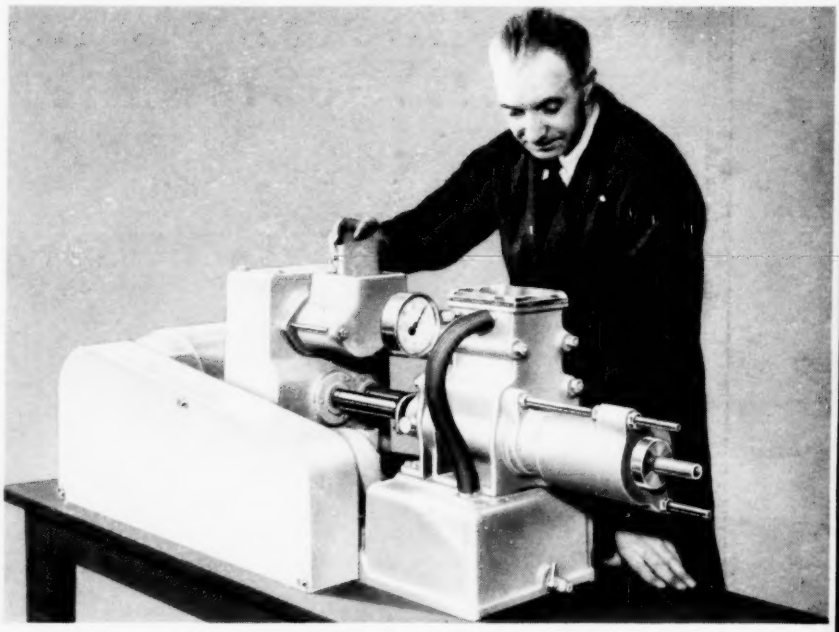
CERAMICS

JUNE
1952

No. 40 Vol. IV



RAWDON 3 INCH DE-AIRING PUG

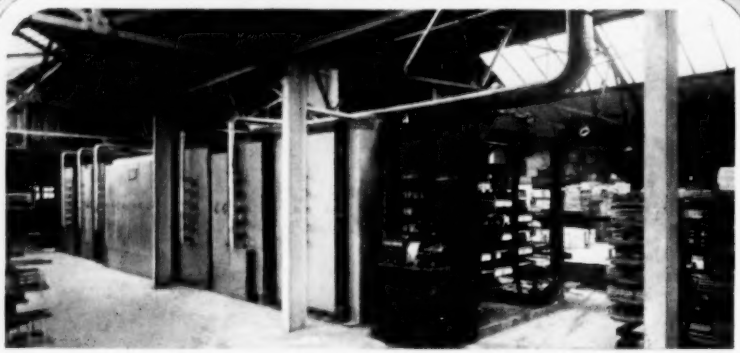
This new RAWDON 3 inch De-airing Pug the smallest in our range is intended primarily as a high-speed production machine where small de-aired extruded sections are required.
If your normal Works output deals with bigger stuff, then we have our 6 inch, 10 inch, and 17 inch machines and this one becomes ideal for your laboratory self contained with motor, drive, vacuum pump and air filter as a single unit.
It is a robust two stage machine with totally enclosed gear box with worm drive. It has feed packing rollers in both top and bottom pugs and adjustable mouthpiece. An important feature is the ease with which it can be totally dismantled for cleaning and correctly reassembled afterwards.

Rawdon

Pioneers of De-Airing Extrusion

MOIRA, Nr. BURTON-ON-TRENT, ENGLAND

LONDON



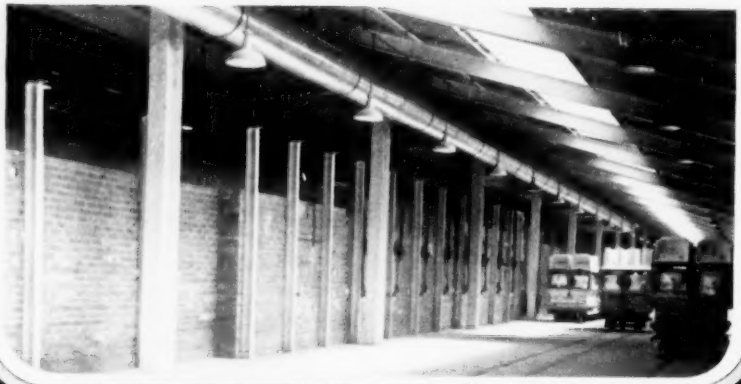
GIBBONS GOTTIGNIES

Passage Kilns

GIBBONS

GIBBONS BROS. LTD. DIBDALE WORKS, DUDLEY, WORCS. Phone DUDLEY 3141

Dressler Tunnel Kilns



Littler

CERAMICS

JUNE, 1952

A monthly journal covering the whole ceramic field including pottery, glass, heavy clay, refractory and silicate industries.

Published Monthly
by
ARROW PRESS LTD.,
157 Hagden Lane,
Watford, Herts

Price 2/6d. per copy.
25/- per year, payable in advance.

FEATURE ARTICLES

	Page
Editorial	147
Comment. By Argus	149
The Third International Ceramic Conference	152
Magnesite Refractories	160
Gustavsberg Potteries. By J. Grindrod	167
The Electron Microscope. By A. E. Williams	177

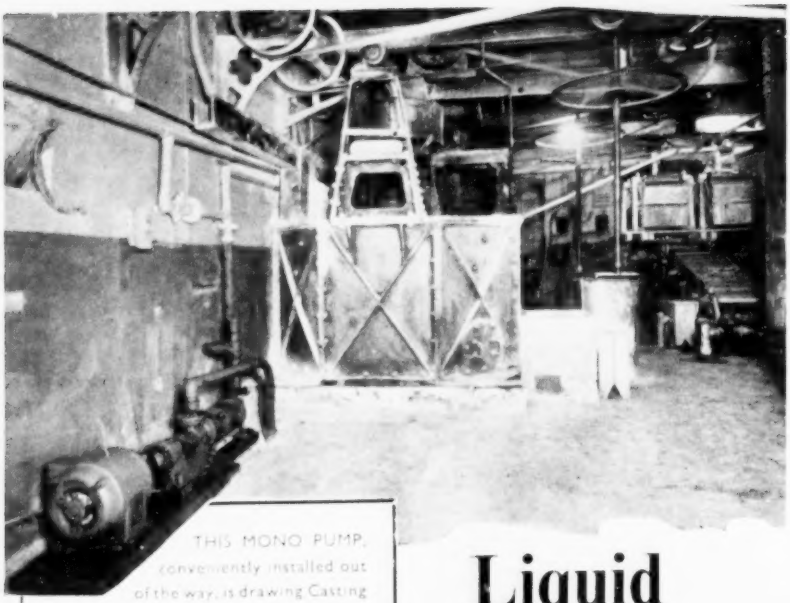
MISCELLANEOUS

Patent Survey	158
Semi-automatic Cup Machines	174
Controlled Waste Heat from Cooling Kilns by means of Louvre Damper	183
English Porcelain of the 18th Century	187
Personalities in the Glass Industry	188
Classified Advertisements	192
Advertisers' Index	192

Copy and Blocks should be available to us by 14th of the preceding month.

They should be sent to:

CERAMICS
157 Hagden Lane, Watford, Herts
Telephone: Gadebrook 2308/9



THIS MONO PUMP, conveniently installed out of the way, is drawing Casting Slip 12 feet from an underground reservoir and pumping to the magnetic sifter.

Liquid Abrasion?

The abrasive content of Casting Slip, Flint or Stone Slop or Glaze can take heavy toll from pumping equipment. The unique principle of the Mono Pump providing a rolling motion between rotor and stator, together with the low and uniform velocity of flow, contribute towards a considerable resistance to wear from abrasive compositions. There are no valves. On filtration duties this steady flow produces a firm and consistent cake and can improve the quality of slip.

Operating delivery on gland there is a complete absence of aeration when pumping to the casting shop.

Add to these advantages, self priming, easy maintenance, space saving and lack of noise when operating and it is clear why so many Ceramic Engineers choose the Mono Pump.

The MONO pump

MONO PUMPS LIMITED

MONO HOUSE, 67 CLERKENWELL ROAD, LONDON, E.C.1

Tel: Holborn 3712 (6 lines) Cables: Monopumps, London Code: A.B.C. 7th Edition

and at Birmingham, Dublin, Glasgow, Manchester, Newcastle, Wakefield.

MP345.BM

Ceramics

VOL. IV JUNE, 1952 NO. 40

INTERNATIONAL PUBLICITY

THERE is still a tendency for Britain to rest on its laurels, looking back to the hey-day of Victorian England. Then she was the workshop of the world. Disraeli had made Queen Victoria an Empress, with India as the brightest jewel in her crown. Then, "what was good enough for us, was good enough for them," was the manner of attacking overseas markets.

Behind tariff walls grew up the mighty industries of Germany, the Low Countries, of Scandinavia and Japan; and with two world wars the unbelievable mechanism of American production.

Today, Britain is no longer in a monopolist's position towards overseas trade. She must compete, and of vital importance in a competitive world is telling one's story by every possible medium.

Britain still tends to hanker wishfully after the old belief that in the ceramic and other fields she is pre-eminent. Maybe so, but not by any means on the important price/quality factor.

In the following pages one can read of the Third International Ceramic Conference in Paris. Not only was it technically sound, but the occasion was taken for France to use the conference, rightly, as a boost to her national accomplishments. The organisation was first-rate—the reporter for CERAMICS was there all the time. He comments that its aim was accomplished in presenting to the 600-odd visitors a cross-section of French life as well as an insight into its ceramic industries. He adds that "as a piece of organisation it was faultless. . . ." He concludes by saying "a high standard has been set which will need a lot of living up to when the congress eventually visits this country."

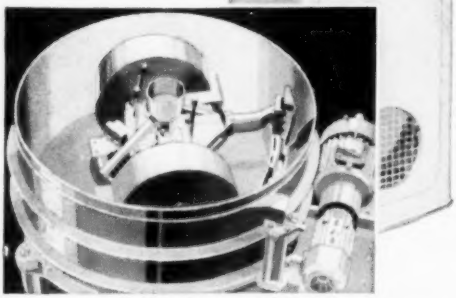
It is important to remember that newer industrialised countries are proud of their own fabrications—and jealous, supremely jealous, of the tag, "Made in Britain." Wherever possible they will adversely comment upon any deficiencies and it is therefore most important for Britain to seize every opportunity for publicity and the equivalent of technical sales service on an international plane to promulgate the idea and to live up to a reputation which must be re-established, that Britain gives the best quality for price in the world. Only the British can sell British goods to buy the food and materials that the British must have.

AUGUST-SIMPSON MIX-MULLERS

for YOUR specific needs

These latest type Simpson "Mix-mullers" provide 'the heart' of your dry-mix process. Through the use of air-floated clays the need for blungers, filter presses, and magnetic separators is eliminated. Proved in use on (a) Refractory Brick (b) Electrical porcelain (c) Tiles and other ceramic bodies. Results are extremely accurate—each batch is controlled to desired specifications.

Inset picture shows the No. 2 size with mullers (adjustable for height from bottom of pan) and the plows which turn over the material and direct it in front of the mullers. The Hood (not shown) supplied as standard for all ceramic installations.



★ The AUGUST-SIMPSON MIX-MULLER Model 00 for laboratory or pilot plant work—capacity ½ cu. ft. per batch. Automatic discharge, this model is fitted with a Three-speed Drive.

Sole Licensees and Manufacturers of the Simpson Mix-Muller for British Empire excluding Canada & Continental Europe.

DEMONSTRATIONS: Our demonstration plant is available for either small or large-scale tests with your own materials. All tests are treated confidentially.

HALIFAX ENGLAND **August's** LIMITED

TELEPHONE: HALIFAX 61247/8/9
TELEGRAMS: AUGUST, HALIFAX

Fantasy and Reality

by **ARGUS**

WE have seen a spate of wage claims—the Amalgamated Union of Foundry Workers for "a substantial increase", the Amalgamated Society of Woodworkers for an extra 6d. an hour; the National Union of Hosiery Workers for a revision of holiday pay; the Amalgamated Engineering Union for £2 a week. Likewise the professional unions—the British Gas Staffs' Association, the National Union of Teachers, and so on, are pressing.

With all these wage claims taken individually, one cannot but help have the greatest sympathy, for irrespective of trade or profession, the cost of living has risen continuously. The Pottery Workers' Society is pressing their claims; yet the fallacy remains.

The Double Squeeze

On the other hand many industrialists and particularly those dealing with basic commodities like metals, paper and so on, are tending to publish ever rising profits. Of course, these profits, when stripped of taxation, become a shadow of their former selves—but the gross figure makes excellent Left-wing propaganda. Likewise increased wages are similarly whittled away by taxation. Factually, however, all industry, including the pottery industry, is subject to the double squeeze—higher profits and higher wages which cannot help but react towards higher prices. We have seen Germany as a nation split once by a Polish Corridor, bankrupt, and a victim of vicious inflation, rally itself and defeat in a few short months the combined armed resources of Western Europe. We have seen them dump their goods abroad at prices less than the cost of production.

When it comes to purchasers, the buyer looks not at the maker's name stamped on the bottom in utilitarian articles. The fact that the quality is down a little and the price is down by 50 per cent. makes the latter a good buy for utilitarian day-to-day use. Of course, it pays to buy the first-class article which will last longer—but limited resources soon put paid to that proposal.

Germany and Britain

Recently, Mr. A. Rist, writing to the *Evening Sentinel*, gave a few comparisons regarding Germany and Britain. The average German wage, excluding coal mining, is £5 17s. 0d. per week, against £7 in Britain. The German pay 20 per cent. more for his flour, 100 per cent. more for his margarine, 90 per cent. more for his butter and 100 per cent. more for his meat. And he does not escape with lower taxation. With an earned income of £300 per annum his tax is up 450 per cent. compared with the same British wage; on £500 a year it is 66 per cent. up; on a £1,000 a year it is 25 per cent. up. Here one sees the relative standard of living of the German worker compared with his British counterpart. The comparison does not end there. As far as natural resources are concerned, as far as population per sq. mile of arable land, as far as home produced foodstuffs per head of the population, we lag behind Germany lamentably. Our one natural resource, coal, can only be produced by national subsidy. We can export only to import materials and food. These are unassailable facts.

No Clear Lead

Nobody likes to see their standard of living fall, but with 50,000,000 people congested into a single island with the demand for consumer goods sky-rocketing by comparison with pre-war, with the Welfare State at its optimum, the writing must surely be seen on the national wall. This is not a matter of politics in any form

whatsoever. One Government had their particular approach and could not stem this wages-profit prices factor. A Government of a different viewpoint finds that it is likewise unable to help. Yet, when each was separately in power, measures put forward by the Government of the day were opposed by its opposition almost on principle, and when the opposition finds itself in Government it introduces the very measures which it once opposed. Because each party sits by to make capital out of the other's misfortune, no clear lead is given to the country and meanwhile that vitally important part—productive industry which includes management and men who alone produce the national wealth—is hamstrung and shuttle-cocked hither and thither.

There seems no solution to that problem for the Tammany Hall at Transport House, and the Tammany Hall at the Conservative Central Office are united on the one fundamental issue which seems that when one is "in" the other will be "out" and vice versa—so everyone is happy except the national wealth makers.

Eastern Standards Affect West

Perhaps things are not quite as bad as they might seem for it is often overlooked that this depression of standards of living in the West is directly due to the increasing standards of living in the East. And since the Eastern population outnumbers the Western population to such a tremendous extent and since the Eastern standard of living is so low by comparison with the West, a 0·5 per cent. rise in the standard of living of these teeming millions has a hundredfold repercussion upon Western standards.

Britain will never again import either food or raw materials at a beggarly price. Yet it goes on adding to the overall costs of industrial commodities, for if the miners get an increase in wages, up goes the price of coal, gas and electricity; and that depresses the standards of the rest of the community. If the hosiery workers demand higher wages, the price of hosiery goes up which in turn depresses the standards of the miners and in the end these excessive wage claims merely cause an inflation of prices—with a depressed buying power at home and excessive prices for goods sold abroad.

There is no answer, of course, to the problem which is now like the river rolling out on to the plain—but at least those members of the middle-class community who are supposed to be the thinking members of the population, should be very hesitant to plight their troth with either political party unless one or the other has the courage to say just where we are going and will tell the truth in simple terms to the people.

Maybe the cynic will say that this kind of thing can only end in an acute industrial depression followed by unemployment and broken businesses whilst out of that morass will again grow something new where the standard of living achieved will again be arrived at by effort rather than by union or trade association resolutions.

But the inevitable crisis can be minimised in its effect if consideration is given to the portended crisis. When the glass shows a drop the mariner battens down his hatches—he joins Davey Jones if he awaits the deluge before he acts.

NEW PRESIDENTS

MR. J. V. GODDARD was recently elected president of the British Pottery Manufacturers' Federation at the annual meeting held at the offices of the British Ceramic Research Association. He is managing director of George L. Ashworth Bros. Ltd., and has been a member of the Federation for 30 years.

Mr. J. R. T. Hay, who is chairman and managing director of Twyfords Ltd., was elected vice-president.

Engineers

Mr. F. J. Goodson, at the annual meeting of the Stoke-on-Trent Association of Engineers held at the George Hotel, Burslem, was appointed president of the Association. Mr. Goodson is principal scientific officer of the British Ceramic Research Association.

Mr. W. Clews, project engineer of the Michelin Tyre Co. at Stoke, was elected vice-president. Other elections were: secretary, Mr. L. W. Carlisle; treasurer, Mr. A. P. Jesshope; asst. secretary, Mr. K. Gatenbury; visits secretary, Mr. S. T. Tew; press officer, Mr. W. C. Colclough; auditors, Mr. R. Evans and Mr. D. J. Emms.

BORAX AND LEAD FRITS
OF ALL KINDS

ALL TYPES OF GLAZES FOR THE
CERAMIC TRADE

TRADE GRINDERS AND SUPPLIERS
OF ORES, MINERALS AND FILLERS, etc.

WET AND DRY GRINDING OF MATERIALS
UNDERTAKEN

SUPPLIERS OF ALL MATERIALS FOR THE CERAMIC
AND ALLIED TRADES

The Third International Ceramic Conference

PARIS—11th to 18th MAY, 1952

(A CERAMICS REPORT)

THE third International Ceramic Congress has come and gone, leaving behind it a memory of magnificent organisation, which included the hottest spell of weather so far this summer.

The recent currency restrictions sadly cut down the number of the British party, but those who were able to go thoroughly enjoyed the programme arranged, which comprised a good balance between lectures, visits and the more social occasions.

Sunday, 11th May, was given over to settling in, and the collection of tickets, badges, etc., from the Congress Headquarters at the Maison de la Ceramique, 44 Rue Capernic, after which the delegates indulging in sightseeing in the finest of Europe's capitals, in what is usually considered to be the finest month of the year.

Formal Inauguration

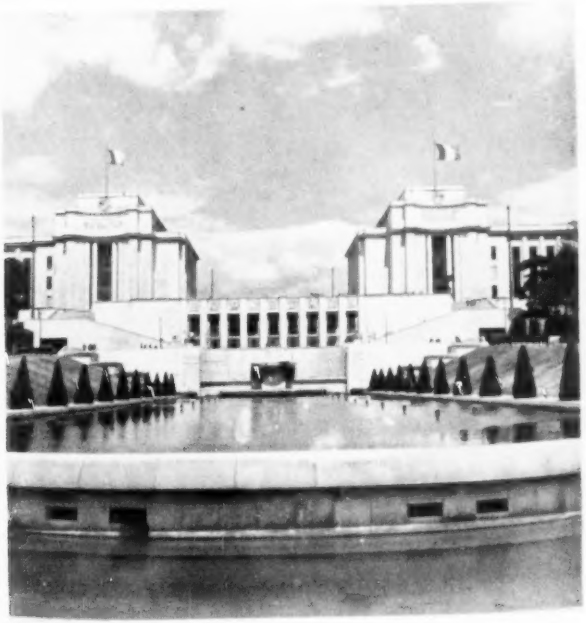
Monday began the business proper of the Congress with a formal inauguration ceremony in the Palais de Chaillot. This was presided over by M. André Carnu, Secretary of State for Fine Arts, supported by the President of the Paris Municipal Council. Speeches of welcome to the delegates were given by M. Louis Desmarquest, President of the Organising Committee of the Congress, M. Othmar Gerster, President of the

The Conservatoire des Arts-and-Metiers

European Ceramic Association, the President of the Paris Municipal Council, and M. André Cornu.

The speeches were interspersed with selections rendered by the Orchestra of the Association des Concerts Colonne under the direction of M. Louis Fourestier.

At the conclusion of this ceremony the delegates were initiated into the long series of luncheons and dinners transferred so as to be nearer the royal court. The new factory is reported to have cost a million pounds, and the manufacture of porcelain prospered here till the war of 1870. Seven years later, in order to allow for extensions, the factory was again moved to its present site, where it has consistently maintained a high standard of quality which has made its products world famous.



The Palais de Chaillot

which, while an unforgettable proof of French hospitality, were eventually to prove a trial to the digestions of those so long accustomed to austerity fare. The luncheon was given at the "Maison de la Chimie", and like all the other ceremonial occasions was a triumph of the chef's art.

Visit to Sèvres

The rest of the afternoon was devoted to a visit to Sèvres to see the "Manufacture Nationale", its museum, also the High School of Ceramics, and the Institute de Céramique Française. Porcelain has been manufactured at Sèvres since 1756, when, in the reign of Louis XV, the manufacture centred at the Château de Vincennes was transferred so as to be nearer the royal court. The new factory is reported to have cost a million pounds, and the manufacture of porcelain prospered here till the war of 1870. Seven years later, in order to allow for extensions, the factory was again moved to its present site, where it has consistently maintained a high standard of quality which has made its products world famous.

At the present time Sèvres is not a factory as we understand it. The present function seems to be the training of craftsmen, and the output is relatively small, but of high quality. This is reflected in the prices of the very fine vases which were on sale. The museum would have been a pleasant place to linger in to reflect on the glories of a more elegant age when Sèvres saw the growth of a new industry, and its products were used to advance the prestige of the Empire. As it was there was time for only a quick walk around the galleries before proceeding to the seat of the Paris Chamber of Commerce for a reception.

This first day had been well filled and was a foretaste of the days to follow.

Tuesday saw the start of the works

visits, which to many of us were to be the high light of the tour.

For these visits the delegates were divided according to individual preference into groups, viz.: refractories, porcelain, earthenware and wall tiles, and bricks and building materials. The heavy clay (bricks, etc.) group had the farthest to travel, going by special train to Lyon where the works of the Tuileries et Briqueteries Lyonnaises at Limonest were visited. The following day the party moved to Montchanin and after visiting the works of Grandes Tuileries de Bourgogne moved on to the Hospices de Baune for lunch. After lunch the Hospice was visited and also the caves used of storing wine. From there the party moved to Dijon, and later took dinner at the Château de Vougeot in company with the brotherhood of the Chevaliers de Tastevin. These societies of winetasters are connoisseurs of wines, and their picturesque robes gave a note of splendour to the proceedings. This dinner was voted a highlight of the trip.

The refractory materials group were able to travel back to Paris each night, visiting the factories of the Société Disticoke at Douvrin on Tuesday, and the works of the Société Nouvelle des Etablissements Emile Muller at Breuillet on Wednesday morning. The afternoon was devoted to visiting the Château at Fontainebleau on the way back. The earthenware group similarly returned to Paris each evening, visiting the works of the Manufactures du Moulin des Loups at Orchies on Tuesday, and the Faienceries de Gien at Gien on Wednesday, returning to Paris via Fontainebleau.

The Porcelain Group

Your reporter accompanied the 110 members of the porcelain group comprising 12 nationalities to Limoges the centre of this branch of French industry. Leaving the Gare d'Austerlitz at 8.30 a.m. the party was in Limoges at 1 p.m. after a comfortable journey in fast electric trains.

After depositing bags at the hotels, the party split up into groups to visit local works including Messrs. Charles Ahrenfoldt, L. Bernardaud et Co., Theodore Haviland, Robert Haviland and C. Parlon, Vignaud, Poral, Legrand, Aluminite, and Société Porcelainière. It was noted that while some factories retained the old kneading machine others were changing to the deairing pug mill.

Semi-automatic machines are made in Limoges to designs very similar to those used in this country, but their use did not seem to be as common as in our own factories, and there was still a preponderance of hand jolleys in those factories seen.

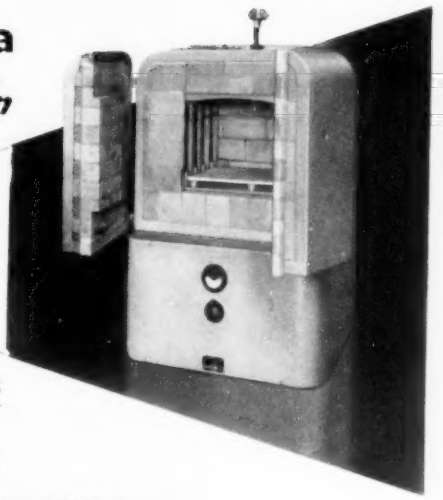
The use of a cloth clamped between two wooden hoops was universal for removing the bats of porcelain body from the batting out machine to the mould. It is placed on the batting machine and the clay placed on it and then flattened out. Its use in transferring the clay is said to prevent crooked ware, especially with large flat ware. The clay bats were placed on the moulds, the cloth removed, and the clay then run down either by hand, or by means of a rubber pad operated mechanically. This idea had not been seen previously by the writer.

Firing

Finally the ware was finished off by jolleying in the usual way. Most of the firing is still down in the two-decker bottle ovens, the biscuit being fired to 800-900° C. in the tops of the ovens and the glost ware in the bottom. Some of the factories had gone over to tunnel firing by Town's gas, and in these the biscuit fire was carried out on travelling metal belts and the glost firing in tunnel ovens of the conventional type maintaining reducing conditions in the firing zone. The cycle was given as four days. The maximum temperature varied with the composition of the body used, but was understood to be in the region of 1,400° C. Decoration was done by hand or by lithos—no mechanical aids were seen in the decorating shops, and the decorating processes seen at the time of the visit tended to be of the simpler types.

The works visits were followed by a visit to the newly reopened Adrien Dubouché national museum. This is one of the finest collections of ceramic art in the world. It has recently been reorganised and the ground floor was opened specially for the delegates. The exhibits on this floor are all porcelain, and are grouped into four main categories: (a) Limoges porcelain, (b) French porcelain excepting Limoges ware, (c) Oriental porcelain, (d)

INVEST in a *New* WEBCOT *Kiln*



LOW FIRING COSTS

A first-class Intermittent Kiln for firing trials and an economical proposition for the small potter.
Please write for Specification No. 7.

WEBCOT LIMITED

LOWER STREET, NEWCASTLE, STAFFS.

European porcelain (except France). It was pleasing to note that the examples of modern work were not inferior to those of former times.

Again the demands of the programme allowed only a brief visit before a reception by the Manufacturers' Federation and attended by the Mayor which was held in the City Museum, formerly the Archbishop's Palace. Here the delegates were welcomed with fanfares blown by musicians attired in full hunting kit with red jackets. Within the museum itself were displayed the glories of mediaeval art as depicted in glorious enamels, which decorated objects of a religious nature such as reliquaries, etc. One had seen pictures of these in text-books, and it was indeed a pleasure to inspect the originals, beautifully set out in this old building.

A brief visit to the Cathedral, gloriously lit by the evening sun, completed this stage of the proceedings, and the day was rounded off by an official reception under the presidency of the Prefect of Haute-Vienne held at the Prefecture—a fine building for a fine banquet.

Tuesday was another full day with an early start for Vierzon where, after a reception at the Mairie, the delegates were entertained to lunch and presented with handsome souvenirs of local porcelain. After visiting the works of Larchevêque at Vierzon the party travelled by coach to Mehan-sur-Yèvre to visit the works and museum of the Société Pillivuyt and Cie. and then on to Bourges. Here a brief visit was made to the cathedral—one of the glories of France—and to the palace of Jacques Coeur. Again the weather was ideal, and the cathedral particularly was seen to the best advantage. Paris was reached after a rail journey of three hours from Vierzon.

Scientific and Technical Sessions

The scientific and technical sessions occupied the next two days and after the very full programme of the preceding days who can wonder that the attendances dropped! Nevertheless for those stalwarts who attended the lectures in English, or even attempted with varying degrees of success to cope with French, there were an

interesting series of papers to be read at the Conservataire des Arts et Metiers in Paris, and if queer things did occasionally happen with the lantern the lecturers nevertheless carried on manfully, and convinced us that we shall have to study their papers in greater detail when they are published.

The British contributions were as follows.

Dr. B. Butterworth.—"The importance of long period exposure tests in the study of clay building materials."

Dr. J. H. Chesters and Mr. J. Mackenzie.—"The value of laboratory tests in forecasting refractory performance."

Dr. A. H. B. Cross.—"The glass phase in silica bricks."

Mr. M. H. M. Richardson.—"Minerals identified in research work on refractories."

Dr. G. R. Rigby.—"The action of ferruginous slags on basic refractory materials."

Mr. A. N. Smith.—"Some investigations on glaze body layers."

Mr. M. R. Johnson.—"Particle Size Analysis by Centrifugal Sedimentation."

As the ladies of the party could hardly be expected to find these lectures interesting the organisers had arranged for them to visit some of the well-known Paris dress designers, perfumers, etc., and it is understood that these visits were a great success.

The newly completed laboratories of the Société Française de Céramique

Having paid tribute to science in the morning the delegates were received by the Mayor of Paris at the Hotel de Ville at 5.15 p.m. and were given the opportunity of inspecting the gloriously painted and gilded rooms with magnificent chandeliers and mirrors. Having refreshed themselves with champagne and sandwiches

the delegates returned to their hotels to prepare for another reception at the Louvre. It was a fine idea to illuminate the galleries of the Louvre, and when completed it will add enormously to the attractions of this world famous museum.

The illumination has been carried out with imagination however, and the effect of picking out the Winged Victory of Samothrace against a black background at the head of a staircase was magnificent. By altering the lighting the effect of the early morning sun shining behind it was reproduced. By such means these sculptures are made to recapture some of the glory which must originally have been theirs, before being placed in the unnatural surroundings of urban museums.

In addition a fine collection of pottery, including some of the work of Palissy was inspected, and after a buffet supper so to bed.

New Laboratories

Friday morning saw the close of the scientific sessions and, as a welcome change from the heat of the city, the delegates were taken by motor coach to the Bois de Boulogne for a garden party. Previously they toured the newly completed laboratories of the Société Française de Céramique, the equivalent of our own research laboratories of the British Ceramic Research Association. These were not yet fully equipped, but sufficient was seen to appreciate that this new building will be a valuable asset to the French ceramic industry. In particular the author noted a small scale brick producing plant and a motor van equipped with recording gear for testing kilns. The laboratories included a section for routine testing of manufacturer's samples. While the gentlemen were doing this visit the ladies visited more of the Paris dressmakers' salons, etc.

Having visited the Bois de Boulogne the organisers no doubt felt that no visit to Paris would be complete without going to Montmartre and so a supper and entertainment were arranged at the Moulin de la Galette in the evening. The Minister of National Education, M. André Marie, presided over the usual magnificent feast, followed by a special show

A COMPLETE ADVISORY SERVICE TO THE CLAY INDUSTRIES

●

In addition to their designing and contracting activities in the world of ceramics, the **International Furnace Equipment Co. Ltd.** can make available to the industry the services of their trained specialists for assisting manufacturers of clay ware in finding solutions to the many problems which face them today.

THIS SERVICE CAN COVER THE FOLLOWING:

- Layout of new works and replanning and re-organising at existing plants.
- Investigation of new lines of manufacture and new methods of production.
- Mechanisation of processes.
- Scientific utilisation of fuel.
- Heat recover and application to ancillary processes.
- Utilisation of low grade fuels.

A preliminary survey of your plant can be carried out for a nominal fee

●

THE INTERNATIONAL FURNACE EQUIPMENT COMPANY LIMITED
ALDRIDGE, STAFFORDSHIRE

which included singing, juggling, acrobatics and conjuring—all turns of the highest quality, and if you cannot swallow a lighted cigarette, drink a glass of water and still puff smoke out of your mouth, there is a magician in Paris who can!' Another late night and so to bed.

Saturday was frankly given up to enjoyment with a visit to Versailles in the day, and to the Opera in the evening. Versailles was cooler after Paris, and not much changed from those war days when it was Supreme Headquarters of Allied Command. After the closing speeches had been made by the heads of the delegations of the various countries the retiring president of the European Ceramic Association was presented with a Sèvres vase. It was announced that Italy would be the next venue of the Congress.

After lunch in the orangery of the Château the royal apartments were visited, including the famous Hall of Mirrors, where the Treaty of Versailles was signed in 1918. After admiring the fountains the party returned to Paris for the Opera where a special performance of "Le Roi d'Ys" was staged.

The Congress undoubtedly fulfilled the aims of the organisers to present to the 600 odd visitors a cross section of French life as well as an insight into its ceramic industries. As a piece of organisation it was faultless, and a word of praise must be given to those who made the arrangements, as well as to those who entertained us so royally. A high standard has been set which will need a lot of living up to when the Congress eventually visits this country.

PATENT SURVEY

COATING HOLLOW GLASSWARE. British Thomson-Houston Co. Ltd. B.P. 657,871.) In this patent is described a process whereby a combustible fluid such as organic silicate is burned at a burner head which is inserted into the glass bulb so that the resulting solid particles of silica are deposited upon the internal surface of the glass bulb.

Enamelling Aluminium-Rich Alloys. Du Pont. (U.S.P. 2,544,139.) According to this patent the surface of the alloy is preheated with a aqueous solution of from 0·25 per cent. to 25 per cent. alkaline chromate and heated for from two to ten minutes at 350° to 600° C. before it is enamelled, and fired at 480° to 580° C. It is claimed to produce a coating which has improved resistance to water-spalling.

Enamel Opacifer. National Lead Co. (U.S.P. 2,547,955.) This refers to improving the opacity of zirconium opacified frit used in vitreous enamelling by the addition of from 2 per cent. to 4 per cent. of a calcined finely grained product containing either alumina Al_2O_3 50 per cent. to 75 per cent. and phosphorus pentoxide and antimony trioxide, 3:1:1.

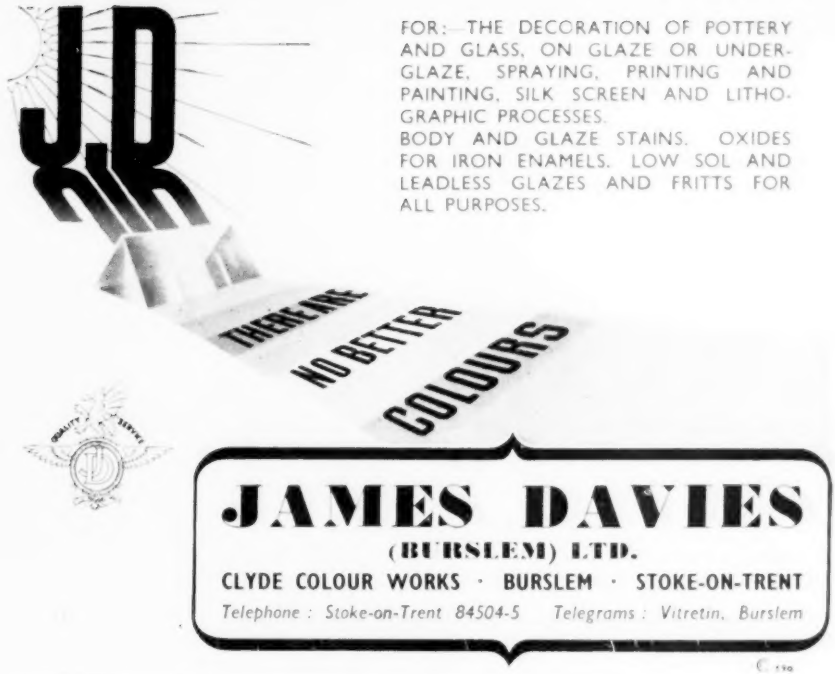
Tunnel Kilns. (B.P. 659,142.) This refers to glazing vapours obtained during the firing of ceramic ware being vented from the kiln by vent pipes spaced at regular intervals in two rows one on each side and arranged longitudinally of the hot zone. The condensate from the pipe collects in troughs in the vertical side walls of the tunnel.

Feeding Clay to Extrusion Machines. (B.P. 658,842.) This describes a clay body being forced downwards by means of a worm of particular application to a vertical extrusion cylinder the upper clay surface is levelled by a rotating arm. Fresh supplies of clay causes the level to be felt and the feed rate varies to maintain a constant level.

Drying Apparatus for Pottery Ware. (B.P. 658,558.) In this application the ware is fired in box-like containers which are assembled side by side lateral perforated flues are registered and connected with a duct carrying hot air which is continuously recirculated through the ware containers.

Centrifugal (Tile) Moulding Machine. (B.P. 660,386.) Here a cylindrical drum rotates about its horizontal axis whilst a cylindrical feed chamber which is open at its front end is held co-axially inside the drum so that it rotates with the drum. Moulds which can be removed are radially placed inside the drum between the feed chamber and the periphery of the drum itself. There are openings in the moulds at their inner ends which register with openings in the feed chamber.

Drying Ceramic Articles. W. T. Copeland and Sons Ltd. (B.P. 659,327.)


J.D
FOR:—THE DECORATION OF POTTERY AND GLASS, ON GLAZE OR UNDER-GLAZE, SPRAYING, PRINTING AND PAINTING, SILK SCREEN AND LITHO-GRAPHIC PROCESSES.
BODY AND GLAZE STAINS. OXIDES FOR IRON ENAMELS. LOW SOL AND LEADLESS GLAZES AND FRITTS FOR ALL PURPOSES.
THERE ARE NO BETTER COLOURS
JAMES DAVIES
(BURSLEM) LTD.
CLYDE COLOUR WORKS · BURSLEM · STOKE-ON-TRENT
Telephone : Stoke-on-Trent 84504-5 Telegrams : Vitretin, Burslem

Here, ware is subjected to a radio-frequency field, in which the earthed electrode is the mould in which the article is either shaped or supported.

Bell-Type Kilns for Burning Ceramics. (B.P. 659,973.) Of Australian origin this describes a kiln which consists of a bell-shaped refractory cover carrying heating elements—it can be lowered over the setting and can be rapidly cooled by means of a stream of air.

Formation of Ceramic Articles. (U.S.P. 2,539,245.) The article is made by floating the mould in casting slip until clay adheres to the required thickness—ultimately it is shaped on a jigger after which it is removed from the mould. It is claimed that shattering and cracking during the firing schedule are thus avoided.

A Potter's Crank. (B.P. 659,431.) This crank designed to support flat ware on edge consists of two loose bars the upper surfaces of which are pointed together with pillars holding a top rail as well as a slot in which spurs pointing downwards may be located in a sliding action.

Decoration. Johnson, Matthey and Co. Ltd. (B.P. 658,910.) This refers to the decoration of heat resisting bases, glass, earthenware and china, by means of a cellulose derivative in the vehicle of a silk screen, gold printing paste which is replaced by a natural or synthetic resin such as, for example, pine oil 70, colophiny 20, methyl abietate 5, castor oil 5 per cent.

Refractory Bricks. (B.P. 659,260.) To obtain such bricks with high heat conductivity, skeleton grains of silicon carbide 75 per cent. to 80 per cent. are embedded in a non-oxidising material such as chromite or magnesite and bonded with sodium silicate containing preferably about 75 per cent. of SiO_2.

A Composite Refractory. (U.S.P. 2,537,012.) This consists of a mixture of spinel such as chromite, magnesium aluminate or magnesium chromite 60 to 80 together with periclase (magnesium oxide 90 per cent., silica 6 per cent.) which is less than 200 inch mesh and amounting to between 20 per cent. and 80 per cent. of the whole which in turn is wetted with a alkali free solution of a chromium compound such as chromium trioxide, magnesium chromate or ammonium chromate. After this the volatilised silica of particle size less than 10μ, from 1 per cent. to 5 per cent. and magnesium oxide less than 200 and not greater than 325 inches mesh are added. Next the mixture is briquetted at 150° to 175° C. and fired at 1,200° to 1,700° C. It is claimed to give a refractory of improved strength particularly suitable for metallurgical furnaces.

Magnesite Refractories

SPECIALLY CONTRIBUTED

MAGNESITE is, strictly speaking, magnesium carbonate, $MgCO_3$, but it is changed on heating to magnesia MgO, a substance of a highly refractory nature and the basis of the so-called magnesite refractories. Its use as a furnace lining was patented by C. F. Claus in 1868 and its importance largely dates from its use by Thomas and Gilchrist in the basic process for steel production (c.f. A. B. Searle "Refractory Materials," 3rd Edition, London, 1940).

Raw Materials

The raw materials for the preparation of magnesite refractories are the carbonate, the hydrated oxide brucite, and of late years the soluble salts of magnesium (the chloride and sulphate) contained in small amounts in sea water. The types of magnesite are usually classified as:

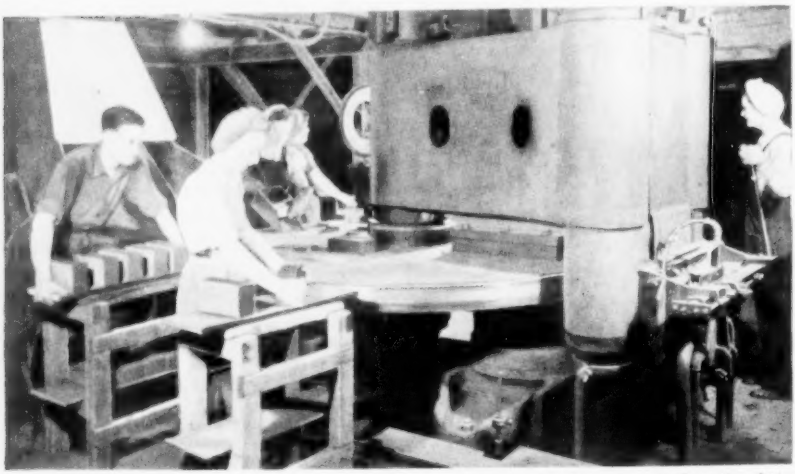
(a) crystalline or spathic.
(b) crypto - crystalline (which appears amorphous to the eye).
(c) breunnerite, which is a solid solution of magnesium and ferrous carbonates.

According to Dr. J. H. Chesters ("Steelplant Refractories," Sheffield, 1944) the principal producing countries pre-war were Russia, Austria, Manchuria, U.S.A., Greece, Czecho-Slovakia, Yugoslavia, Canada, India and Australia.

Austrian deposits of breunnerite were used as far back as 1880 for the original development of magnesite bricks, and it was not until the 1914-18 war cut off supplies that other deposits became important. History has repeated itself, since the demand for magnesium alloys in the last war led to the production of magnesia from sea water.

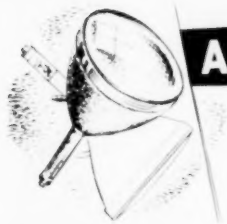
Extraction of Magnesia from Sea Water

Although it had been known for a long time that sea water contained magnesium salts, no economic method of extraction was known. It was found that the magnesium could be precipitated as hydroxide by additions

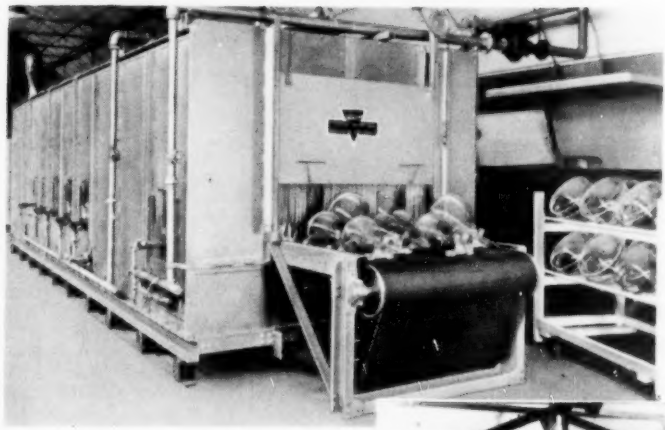


(Courtesy, Cornell Iron Co., Ltd.)

A multiple-mould 800-ton hydraulic press in operation



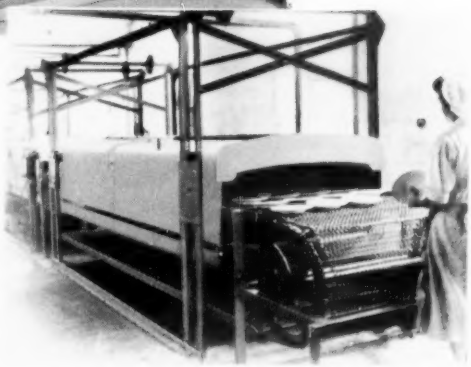
ALL ROUND HEAT DISTRIBUTION



"Wedco" Woven Wire Belt Conveyor handling cathode ray tubes through gas-fired glass annealing Lehr.

"Wedco" Woven Wire Belt Conveyors are ideally suited for handling Pottery and Glass through Furnaces and Lehrs because the open mesh of the heat resisting belt ensures an efficient all round distribution of heat to the load being carried. Moreover, the Belts are equally at home in high or low temperatures and, as their length remains unaffected, they do not require constant adjustment. Their initial cost is surprisingly low and they have an extremely long life.

Our Technical Representative in your area will gladly assist you with *your* handling problems entirely without obligation. Alternatively, may we send you our latest Catalogues ?



"Wedco" Woven Wire Belt handling porcelain through infra-red dryer.

Wedco

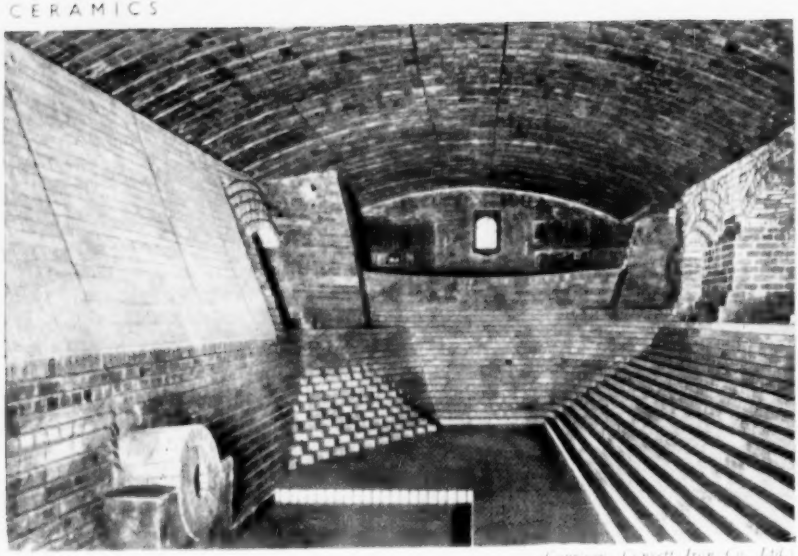
THE BRITISH WEDGE WIRE CO. LTD.

ACADEMY STREET WORKS, WARRINGTON

Telephone: Warrington 3207 (3 lines) Telegrams: Wedco, Warrington

London Office: 607 Finchley Road, N.W.2. Telephone: Hampstead 0481 (3 lines)

TECHNICAL REPRESENTATIVES IN ALL PARTS OF THE BRITISH ISLES



Courtesy, Consett Iron Co., Ltd.

Interior of all-basic open hearth furnace in course of construction at the Consett steel melting shop, utilising Consett refractories throughout. Magnesite below sill level.

of slaked lime. Later H. H. Chesny patented a process in which slaked dolomite was substituted for lime. As Dr. Chesters points out, this solved two problems simultaneously, the extraction of magnesia from sea water and from dolomite.

$$Ca(OH)_2 \cdot Mg(OH)_2 + MgCl_2$$
$$2Mg(OH)_2 + CaCl_2$$
(slaked dolomite) (sea water)

The method used in this country has been described by M. Douglas (Refract J. **21**, 11, 1945). The magnesia content of sea water is approx. 0·2 per cent. and 112,000 gallons are required to furnish one ton of magnesia if lime alone is used as precipitant. With slaked dolomite the volume required is less. The water is first treated to remove bicarbonate ions and to precipitate calcium carbonate. The dolomite required is fired in continuous producer gas fired shaft kilns 9 ft. in diameter and about 60 ft. high. To prevent contamination with calcium sulphate the producer gas is scrubbed free of oxides of sulphur. The calcined dolomite is tested for the presence of undecomposed calcium carbonate, which would pass through the process unchanged, and which would ultimately lead to the undesirable presence of free lime in the magnesite. The calcination is a vital part of the process since all carbonate must be decomposed, yet overheating makes slaking difficult. The calcined dolomite is crushed to pass a $\frac{1}{8}$ in. mesh and stored. It is slaked with hot, fresh water, taking care to avoid crystallisation of calcium hydroxide since this form is relatively inactive. The slurry is then passed to settling tanks where unslaked material settles. It is then filtered through a 100s lawn and is ready for the reaction.

The plant described in the above paper dealt with over 1,000 tons of dolomite and 65 million gallons of sea water to give 800 tons of magnesia each week.

The Reaction

This is carried out in the cold, the sea water being fed upwards into a reaction vessel and the dolomite-lime slurry, being sprinkled in by spinning it off a rotating horizontal disc. To avoid precipitation of the salts of calcium formed in the reaction only about 70 per cent. of the total magnesia present is precipitated as hydroxide.

This gives insufficient concentration of calcium compounds to saturate the water. At this stage strict chemical

control is essential. The reacted mixture then flows by gravity to settling tanks of 2½ million gallons capacity, from which the spent sea water overflows back to the sea. The settled slurry is heated to 90° C. before filtering on continuous vacuum filters. It is then ready for calcination which is carried out as for magnesite.

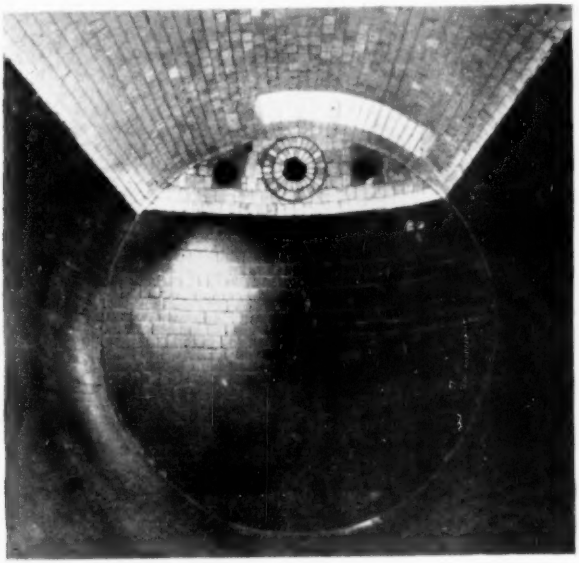
Calcination

On heating magnesite to 800-900° C. it loses carbon dioxide and is converted to what is known as "caustic magnesia." Further heating at higher temperatures forms a hard sintered material called "dead burned" magnesia. This is the principal constituent of magnesite bricks. The effect of dead burning is to get the magnesia into a form where further volume changes in service are reduced as much as possible. Volume changes in the bricks may occur as a result of hydration or of a change in crystal size. It has been shown (J. H. Chesters op. cit.) that on heating above 1,400° C. the specific gravity of magnesite rises fairly rapidly to a maximum at 1,650° C., and that this is accompanied by an increase in crystal size. This reduces the surface area, and, with it, the tendency to hydration.

The rate at which "dead burning" proceeds can be increased by suitable additions, and many have been patented, e.g., calcium ferrite. Pure magnesia has been estimated to melt at 2,500° C., but sintering proceeds at a much lower temperature especially in the presence of impurities in the natural minerals. In particular the presence of ferrous carbonate $FeCO_3$ may make dead burning possible at about 1,500° C. Crystals of magnesio-ferrite $MgO.Fe_2O_3$ have been detected in the fired material as well as periclase MgO. In addition the following other substances have been detected in the dead burned material, e.g., fosterite $2MgO.SiO_2$, fayalite $2FeO.SiO_2$, monticellite $MgO.CaO.SiO_2$. Complex magnesium-lime silicates are also present and serve as bonds when the refractory bricks have been fired and cooled.

Types of Kilns used

Two types of kiln are used for roasting the clinker, the intermittent shaft kiln, which is a development of the old time kiln, and the continuous rotary kiln. Formerly the fuel and magnesite were mixed, but to get the product free from ash this process has largely been replaced by producer gas firing. According to A. W. Comber ("Magnesite as a Refractory," London, 1937) temperatures up to



Hot metal mixer in course of relining with Magnesite bricks

(Courtesy, Consett Iron Co. Ltd.)

1,700° C. can be obtained in a shaft kiln, though this is rarely necessary. An average sized shaft kiln should give 12-14 tons of sintered magnesite a day. The shaft kiln can be made continuous in operation, fresh material being added at the top to replace the burned material removed at the bottom.

As in the cement industry modern practice favours the use of the rotary kiln. This is a steel cylinder, lined with suitable refractory materials, which is rotated at an angle to the horizontal. The raw material is fed in at the upper end and is heated in its passage through the kiln by hot gases moving in the opposite direction. The size of these kilns depends on the output required.

One large Austrian kiln had a diameter of 9½ ft. and was 330 ft. long and gave an output of approx. 200 tons a day. The temperature in the firing zone was approx. 1,650-1,700° C., and the fuel consumption was about 8 cwt. per ton of calcined material. After heating the clinker is crushed and graded. Electrically fired magnesia is being made in small amounts and used for very severe service conditions. For further details the reader is referred to A. W. Comber's excellent book (op. cit.).

Manufacture of Bricks

The crushed clinker is graded according to manufacturers' usual practice. A. W. Comber gives as a rough approximation one third between 1/8th in. and 1/50th in., one third between 1/50th in. and 1/200th in., and one third finer than 1/200th in. This is mixed with about 5 per cent. by weight of water for machine pressing (slightly more for hand moulding), and allowed to stand. Dilute solutions of sulphite lye are sometimes used for greater green strength. Iron oxide is sometimes added to promote sintering and increased density, and 2-6 per cent. of alumina improves thermal shock resistance.

Souring and Pressing

After mixing with water, souring is often adopted by standing the mixture for 1-10 days, or by autoclaving with steam. According to Dr. J. H. Chesters this is only necessary where the clinker contains free lime, and avoids losses due to cracking in drying. Where the lime content is negligible souring can be dispensed with. Whereas hand moulding or light pressing was used for shaping, modern practice is to use hydraulic presses with pressures around 10,000 p.s.i. This gives a dense brick.

Drying

Unless carefully controlled this part of the process can occasion excessive losses by cracking. The three principal causes of cracking are:

(a) underfired magnesite,
(b) excessive drying temperature,
(c) too much fine material in the brick (c.f. J. H. Chesters (op. cit.).

These conditions favour hydration of the magnesia with accompanying expansion and fracturing of the bricks. In general drying is either carried out in rooms only slightly above atmospheric temperature in tunnel dryers where conditions are carefully regulated.

Firing

This is carried out at temperatures about 100° C. lower than that at which the clinker was formed, the aim being to fuse the glassy material present which acts as the bond on cooling. The fired product should show less than 1 per cent. shrinkage when subjected to a reheat test at 1,500° C. for two hours.

In order to avoid the danger of squatting the bricks are not piled too high on each other and boxing in silica bricks is often used, especially in intermittent kilns, to take some of the load off the lower bricks. Where this is done the rate of heating has to be slower than the magnesite bricks would stand to avoid undue casualties with the silica bricks.

Beehive kilns, chamber kilns and tunnel kilns are all used for firing. The beehive is commonly 30 ft.-40 ft. dia. and may hold 30-35 thousand magnesite bricks with the additional boxing material. Heating up occupies 5-6 days and cooling a similar time, so that the kilns are turned round once a fortnight. As with other types of ceramic ware the beehive kiln shows a relatively high fuel consumption and uneven temperature

DUCTING
•
SHEET METAL WORK
FOR THE
POTTERY INDUSTRY
BY
STEWARTS (HANLEY) LTD
NEW STREET, HANLEY
PHONES - - - - STOKE-ON-TRENT 5161-2

distribution. Chamber kilns fired with producer gas give better fired results, and because heat recuperation is possible, the fuel consumption is smaller. Tunnel kilns are also used and one built pre-war in Austria was 400 ft. long and gave a daily output of 60-80 tons of fired brick.

In addition to the fired brick there is a chemically bonded type which needs no firing. It is very strong and useful for certain applications.

Properties

The melting point of magnesia has been assigned values ranging from below 2,000° C. to 3,000° C. In the brick itself it is not the magnesia which fails in service but the glassy material which acts as the bond. The amount and nature of the latter determines how it will behave on heating. For this reason the *refractoriness under load* of magnesite bricks is comparatively poor. Under a load of 50 p.s.i failure of commercial bricks often occurs in the region of 1,540° C., softening beginning about 100° C. below this temperature. Under a load of 28 p.s.i. failure with the best type of bricks may not occur till somewhere in the region of 1,600° C.

Specific heat is higher than that of fireclay and increases with rise of temperature. The value at ordinary temperatures given for two well known types is 0·225.

The thermal conductivity varies with composition of the brick, but is relatively high. The values however, fall with rising temperature. For one type the value given at 600° C. is 40 approx. (BTU/ft./hr./1°/1" F.) falling to 25 at 1,400° C., while another, higher in alumina gives corresponding values of 25 and 14.

Thermal expansion is relatively high being 1·2-1·4 per cent. over the range from room temperature to 1,000° C. It increases above this temperature.

After contraction is usually determined by heating the bricks and maintaining them at 1,500° C. for two hours. It is important that this shrinkage should be very small so as not to open up joints, especially where these

are in contact with molten metal. Well fired magnesite bricks show very small after-contractions.

Resistance to thermal shock is usually improved where required by small additions of alumina to the brick. This on brick with 1-3 per cent. Al_2O_3 and 85-90 per cent. MgO give a spalling index of 4, while another with 5-6 per cent. Al_2O_3 and 86-88 per cent. MgO gave a value of 30+. Spalling resistance is also improved by the use of metal cased bricks. In these the brick is sheathed in steel on three sides. The open magnesite face is built in towards the furnace and the bricks cemented together with a paste of dead burned magnesite. Eventually the iron oxidises and combines with the magnesia to form a strong bond holding the bricks together.

The strength of magnesite bricks is high when cold but relatively lower than other refractories when hot. Varying values are given for cold crushing strength. One well known firm gives values of 4,000 and 6,000 p.s.i. for two of its bricks. Dr. Chesters (*op. cit.*) quotes values > 8,300 p.s.i. for bricks used in the bottom of a basic open hearth furnace and 5,120 p.s.i. for a chemically bonded magnesite brick.

Porosity depends on the method of manufacture. For fired bricks quoted values range from 18·5 to 24 per cent. and slightly over where porosity is slightly higher. Unfired, chemically bonded bricks, are less porous.

Specific Gravity of a magnesite brick depends on its composition and a good quality brick may have a value of 3·55. The specific gravity of pure magnesia is according to Dr. Chesters 3·583. Could magnesia bricks be made of pure MgO the specific gravity might be used as an indication of the conversion to periclase in firing. As it is variations in the composition of the raw material make it possible to have products with the same specific gravity but with different refractoriness.

Applications

Magnesite refractories showed high resistance to attack by slag rich in iron oxide and lime. Their principal application is for the open-hearth furnaces, arc furnaces, and hot metal mixers. In open hearth furnaces they are used in the hearths and lower courses of the walls and in electric furnaces in the bottom and side walls. In metal mixers they are used for the linings. Magnesite bricks are also used in converters used in the smelting of copper and in the cement industry for refractory kiln linings.

Bibliography

For further details the reader is advised to consult the following excellent books, which contain extensive bibliographies: —

A. W. Comber. "Magnesite as a Refractory." London. 1937.

J. H. Chesters. "Steel Plant Refractories." Sheffield. 1944.

THE SCOTTISH DIATOMITE INDUSTRY

THE diatomite industry in Skye is making steady progress and will employ double the labour force now used, by 1953, when production will be getting really into stride. Since this project was initiated 2 years ago roads have been built in to Loch Cuithir where the 65 ft. deep, high quality, deposits are located. The loch has been drained and a factory located at Invertote. The clay is dug from the drained bed and transported to the factory where it is air dried, before being given a final drying by hot air circulation.

The quality of the diatomite is regarded as being fully up to the standard of the best imported American qualities while rising world prices have made the Skye venture economic.

Diatomite was worked here previously in 1913 but the workings were then abandoned owing to lack of support. Since then there has been a major expansion in the market for diatomite, for filtration purposes, for refractories, plastics, for insulation and a host of similar purposes. This expanded market is a guarantee that the Skye diatomite will find a steady demand in the home market, where there are only two other deposits of commercial scope.

S. Jarvie. Mr. S. Jarvie, B.Sc. (London) has been appointed deputy director of The Building Centre (Scotland) Ltd., Sauchiehall Street, Glasgow, and has taken up his duties. He succeeds Mr. A. Campbell, who has now gone into private practice. Mr. Jarvis plans to extend the scope of the Centre by arranging regular exhibitions and meetings and is seeking co-operation from building industry firms in Scotland.

GUSTAVSBERG POTTERIES

by

J. GRINDROD (B.A.Com.)

From time to time much is written about pottery production on the Continent, and in this article the author surveys the methods adopted by a well-known Swedish pottery.

PLEASANTLY situated on the Island of Värmdö, about 15 miles from Stockholm, the Gustavsberg Potteries are among the most modern in the world. Yet, although up-to-date methods of production have been studied and adopted, Gustavsberg is a factory with its roots deep in history and tradition, and this has made possible a happy blending of accumulated and inherited craftsmanship with the scientific knowledge available today.

Background

Gustavsberg Potteries were established in 1827 on the site of an old ceramic plant that had been producing since the middle of the 17th century. For about 90 years the factory had been operated by a family company but was later acquired by the Swedish Co-operative Union after a period of prolonged depression during which Swedish manufacturers of china had suffered greatly from continental cut-throat competition on the Swedish market.

Before the change-over took place, however, a start had been made in the modernising and rationalisation of the business and this work of converting the old factory into a modern plant has been pressed forward, especially since 1937, by the present owners, under the very able and efficient management of Hjalmar Olson.

At Gustavsberg the old intermittent kilns are almost a thing of the past. A few have been retained more or less as museum pieces and for occasional use in calcining flint balls to make them more brittle and fit for crushing and milling. Gone, too, are the large smoke stacks of the steam plant which furnished the power for the crushers, ball mills, pug mills and

Earthenware of modern design by Gustavsberg potteries of Sweden

all the rest of the heavy machinery used in the preparation of the clays and minerals which make up the body of the china.

In the old days the management of Gustavsberg used to reckon they risked an investment of 40,000 kronor with each firing in the large intermittent kilns formerly in use due to deformation and breakage of both saggers and ware. It used to be reckoned that the firing of 100 lb. of china at 1,400° C. required 100 lb. of best quality coal, and the filling and emptying of the kilns demanded great skill and physical strength as well as a period of 72 hours to reach maximum temperatures and two days for cooling off.

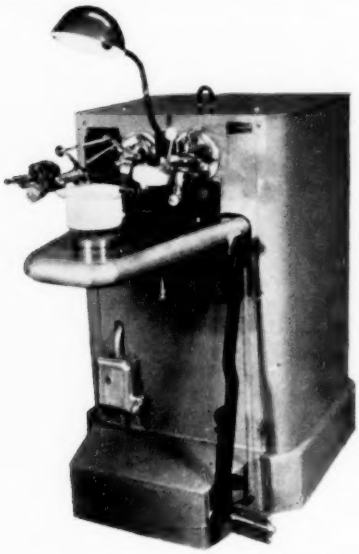
Plant Available

Today, the plant is composed of gas-fired and electrically heated ovens. First of all, a long gas-fired continuous oven was installed. In this the temperature slowly rises and the ware is pre-heated as the trucks carrying it are gradually drawn towards the combustion zone in the centre of the kiln, where the maximum temperature is reached. After the firing the ware is gradually drawn away and cooled off, finally reaching the end of its journey at approximately room temperature 48 hours from its initial entry into the tunnel. This first gas-fired kiln was followed by many others especially in the household china divisions where they are used for firing flintware and bone china. The fuel for these continuous kilns is generated in a compact gas plant belonging to the works and consists of a mixture of coal and wood gas. Those gases harmful to the china and containing no calorific values are drawn off up a modern silver-plated flue which stands near to the still remaining squat chimneys of the old intermittent kilns.

The first 350 ft. long electric ovens were put into production in 1940 in a new factory for sanitary-ware, but they are also now being used for firing a great many other ceramic products. In addition there are electric or gas-fired muffle ovens used for firing the colours of the ware.

These continuously operated tunnel ovens form the focal point of production. By their use the bottleneck of china manufacture was broken and around them the production of china has been streamlined. As much as possible of the work has been mechanised and the internal transport of the ware between its different stages of manufacture follows a modified

Interior of sliphouse serving the needs of the household ware divisions



GOLD EDGE LINES

THE "RYCKMAN" GOLD EDGE LINING MACHINE PRODUCES GOLD EDGE LINE OR STIPPLE ON CUPS, SAUCERS, PLATES, ETC. UNSKILLED FEMALE LABOUR MORE THAN DOUBLES THE USUAL OUTPUT WITH SUPERIOR RESULTS AND A CONSIDERABLE ECONOMY IN GOLD CONSUMPTION.

Manufactured in England by

F. MALKIN & CO. LTD., LONGTON, STOKE-ON-TRENT

TELEPHONE: LONGTON 3873

production line method. All stages of manufacture have been carefully studied and broken down. For instance the production of a coffee cup now entails seventy-nine different operations. This time- and motion-study has resulted in greatly increased output per worker.

Imports from Cornwall

The Swedish kaolins lack sufficient plasticity to be used in the china industry and the raw material used at Gustavsberg is imported from Cornwall. Ball or sedimentary clay is also imported from Britain. Some of the purest deposits of feldspar in the world are found in Sweden, but, for practical reasons, flint is imported in the form of balls collected on the beaches of Denmark, France and Belgium. They are calcinated at about 600° C. when a sudden change occurs in the size of the individual crystals. The whole structure is loosened and the flint becomes more easily ground to the required firmness.

After calcination the hard minerals are crushed to a fineness of 4-5 mm. Later they are milled further in a ball mill to a fineness of only a few hundredths of a millimeter. The ground minerals are then mixed with clay in the desired proportions in a blunger. The body slip thus obtained is screened and passed through the jaws of strong magnets to remove any existing iron particles before it is piped into storage vats. From here the slip is pumped into filter presses where the water is removed, leaving a plastic cake which may be fashioned into any desired shape.

In order to get a completely homogeneous body structure before shaping, however, the filter cakes are passed through a pug mill where they are cut up and pressed into a vacuum chamber to remove the air. The homogeneous and de-aired paste leaves the pug mill nozzle in the form of a continuous column from which pieces are sliced off as required.

Shaping Methods

The four shaping methods used at Gustavsberg are throwing, jiggering, turning and extruding.

Throwing is now confined to the shaping of special art-ware and stoneware. Jiggering is employed for plates, cups and similar symmetrical objects. A moulder reckons to produce about 500 cups an hour by this method.

Turning is the method adopted chiefly for technical porcelain, e.g., insulators and bushings.

Tubes and rods are produced by extrusion. For this shaping method special pug mills have been designed. They may be fitted with a mouthpiece or die having the desired cross section, and the paste is forced through the aperture. A profile rod produced in this manner may later be sliced into thin pieces or fired as a long rod.

For asymmetrical objects, casting is the shaping method generally employed at Gustavsberg. This method is used for such domestic ware as pitchers, tureens and similar objects, while sanitary-ware is shaped entirely by casting. In employing this method the filter cakes are first dissolved in water to which 0.1 per cent. sodium carbonate and sodium silicate have been added as deflocculating agent. This makes the slip sufficiently fluid for pouring despite the fact that its moisture content is only 27 per cent. or only slightly higher than in the homogeneous body used for throwing or jiggering.

The plastic moulds are filled with slip continuously pumped through the plant. This is done in the morning. Part of the water is absorbed by the mould and the surplus slip is tapped off. After a few hours the moulds are broken apart and the green pieces left to dry. The slip used for sanitary-ware is not de-watered in the filter press but is kept agitated in the vats and from there circulated through pipes to the casting benches.

For the mass production of small radio and electrical components and similar objects intended for assembly, and therefore requiring certain definite limits for their dimensions, pressing is used. In the semi-dry process the dry filter cakes are thoroughly disintegrated into dry powder, which is mixed with small quantities of water and oil. The powder is poured into a die inserted in a press, and by lowering the plunger of the press the plastic powder is forced into all the cavities of the die. The piece is then ejected and left to dry before being fired.

Dryers

At Gustavsberg the dryers used are designed to permit the temperature

Electric heating element of the electric tunnel kilns in the sanitary-ware division

and moisture to be accurately determined at all points in the continuously operated plant. To speed up the process, humidity dryers are used wherein the same percentage of water is taken out of the interior of an object as from its surface, thereby preventing cracks. Incidentally, here again, advantage as far as possible is taken of the line method of production. For example, plates shaped by two jiggers put on a conveyor which slowly moves them into and through the humidity dryer.

At Gustavsberg stone-ware and sanitary-ware are dipped into glaze in the green state and then fired once. Practically the entire production of table-ware is fired twice, first for the biscuit-ware and a second time for the glaze. Glaze is applied both by dipping and by spraying by means of a gun.

Various methods of decoration are used at Gustavsberg. Copper engraving, developed in the 18th century, is still widely employed.

As already mentioned both gas-fired and electric ovens are used for firing. Apart from the obvious advantages of cleanliness and economy of fuel, etc., these tunnel kilns are so constructed that air, heated in cooling the ware, is drawn into the combustion zone where it is used to help raise the temperature there. Also hot air is conveyed, by means of ducts in the crown of the funnel and blowers, to other parts of the plant for drying and heating purposes.

Art-ware and other small volume output demanding special care is fired in electric intermittent kilns.

Artists and Designers

Not by any means the least important department at Gustavsberg is that of the artists and designers. Indeed, of such importance is it regarded by the management that complete freedom has been given the artists to follow, regardless of the limits imposed by production or commercial considerations, the paths of their own creative imaginings in their own leisurely fashion. They have been granted their own independent studio where free reign can be given to artistic moods and expressions.

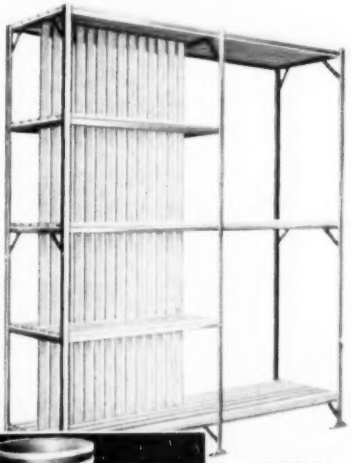
The studio output consists in part of unique pieces and the annual

YEARS of EXPERIENCE

are behind each item in the range of

SAMCO

FACTORY EQUIPMENT



STORAGE RACKS

Built from standardised steel units or to customers' own requirements.

BINS AND TRAYS

Supplied in standard sizes or made to order.

MOVABLE RACKS

An example from our wide range : a five shelf rack.

B. U. SUPPLIES & MACHINERY CO. LTD.

LAW STREET SAMCO LEICESTER

Stoneware, by Stig Lindberg

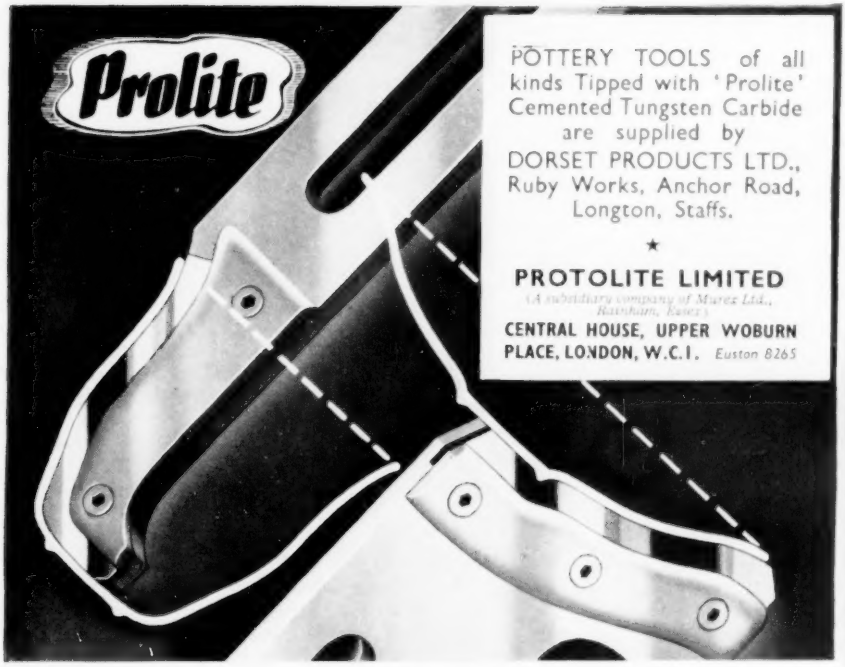
exhibitions of the studio have become outstanding events among Swedish connoisseurs of ceramic art. Indeed, examples of Gustavsberg art is to be found in the collections of leading museums both in Europe and America.

Occasionally a ware is developed and found suitable for a studio-crafted production—a practice similar to that of the ancient Chinese who used skilled craftsmen for reproducing the artist's original but with variation in detail. This studio-crafted pottery has been made available to the American public in limited quantities. They are of excellent design and superlative workmanship.

Wares of Distinction

Prominent among the ceramic artists at Gustavsberg's studio are Wilhelm Kage, director of the studio, Stig Lindberg and Berndt Friberg. Among the wares of distinction may be specially mentioned Argenta, a semi-vitreous ware turned on the wheel and glazed in a wide range of greens from lucid emerald to olive and moss with sterling silver decor in almost infinite variations which by a special process is fused to the body i. become an integral part of the ware. Gold Carrara is decorated with pure gold applied to a matte tin glaze in bands or simple geometrical patterns. Grazia, a vitreous stone-ware, is elaborately decorated with figures applied in sterling silver. The latter is the work of Stig Lindberg who has also been responsible for the renaissance in faience ware with its coloured body covered with white opaque tin glaze fired at a rather low temperature to permit an unrestricted polychromatic decoration.

Although many industries in Sweden are to be found with rural settings, Gustavsberg occupies a unique position among the Swedish one-industry communities because of the company's exclusive ownership of the entire town and its public facilities. Hand in hand with the modernisation and rejuvenation of the plant, Gustavsberg are offering more and more amenities to their workpeople both inside and outside the factory.


Prolite
POTTERY TOOLS of all kinds Tipped with 'Prolite' Cemented Tungsten Carbide are supplied by
DORSET PRODUCTS LTD.,
Ruby Works, Anchor Road,
Longton, Staffs.
★
PROTOLITE LIMITED
(A subsidiary company of Murex Ltd., Rainham, Essex)
CENTRAL HOUSE, UPPER WOBURN PLACE, LONDON, W.C.1. Euston 8265

KERAMISCHE ZEITSCHRIFT

THIS journal is one of the leading European periodicals for ceramics, and caters for everyone engaged in the industry throughout the world.

It is well known for authoritative leading articles, for the high quality of its photographic reproductions and the advantage it enjoys of the confidence and co-operation of the best manufacturing firms. The Keramische Zeitschrift (Ceramic Journal) deals with the progress and history of the clayworking industry in all its aspects from the raw materials through processing to the sale of the finished article. Contributions by recognised experts guarantee the high standard maintained in its editorial columns.

A specimen copy will be forwarded on request.

Monthly—Subscription £4 5s. per annum, plus postage

Publisher: **Verlag G. Schmid**

Post Box (Postfach) 198, (24a) Luebeck, Germany

SEMI-AUTOMATIC CUP MACHINES

by

ERIC EVANS

AFTER using these machines for the last year or two, I have a great deal of faith in them, and consider that they will stand up to any test, providing that the management as well as the workpeople have a sensible, unbiased attitude towards their introduction. Semi-automatic cup machines have, in my opinion, several good points in their favour: here are four of them:

1. *Cost.* There can be no doubt that a higher output of cups per maker can be obtained.
2. *Loss.* Should be negligible.
3. *Quality.* As far as the machine itself is concerned, it should be first class. This does not mean to say that the introduction of a semi-automatic cup machine will solve everybody's troubles as regards quality. I maintain that the poorer quality comes from the poor finish or dirty workmanship of the operative just as on the hand jigger, and so will have to be tackled along similar lines.
4. *Adaptability.* These machines were put into use in the first instance for mass production of the so-called "utility" lines, yet I consider that they can be used efficiently to suit a varied output even if it means making a different shape of cup each day.

Mechanical Breakdowns

The main disadvantage generally brought forward against the use of these machines is that of time lost due to mechanical breakdowns.

I have only one answer to that point. There are thousands of machines in constant use throughout industry today which are much more complicated than a semi-automatic cup machine. If we cannot keep a machine working for 8 or more hours per day without any serious technical hitches arising, then one section of the industry will not advance very far!

Let us consider this question of "breakdowns" a little more fully.

In the first instance, the makers of these machines have gone as far as they can for the time being in mechanising the making of a clay cup: a semi-automatic machine is, in effect, several machines, operating in one!

For example:

(a) They provide a tool-holder which is brought down on to a "set pin" and returned at certain intervals.

(b) A scrapper holder which is brought down to a set position and returned.

(c) A spray gun spraying water at a variable time and period.

(d) A moving turntable to move the moulds or rings to the various set positions.

(e) A rotating spindle, jigger head or heads.

Any failure in the above components, such as the scrapper not coming into the exact position on each operation, or the tool-holder not coming on to the set pin on each operation is definitely due to a fault in the machine itself.

If the scrapper mechanism on a machine is operated with a complicated linkage of six pivot pins then it does not want much "play" in each to cause a distinct variation in the action.

If the making tool comes into the clay too fast in more of a "snatching" than a "pressing" action, then don't be afraid of telling the maker of the machine that it just won't do! Or, better still, take the "cam" off and alter it yourself.

A talk given to The British Pottery Managers' and Officials' Association, Stoke and Hanley Branches, on 19th May, 1952.

AUSTRALIAN

ZIRCON

(99·5% $ZrSiO_4$—100, 200, 325 mesh and special purified ceramic grade)

FOR CERAMIC GLAZES, VITREOUS ENAMELS, ELECTRICAL PORCELAINS AND REFRACTORIES

F. W. BERK & CO., LTD.

Commonwealth House, New Oxford Street, London, W.C.1—Chancery 6041
Fountain House, Fountain Street, Manchester 2—Central 6996
65, West Regent Street, Glasgow, C.2—Douglas 8338

It must be realised that we pottery managers are not the only people whose products are not always up to scratch.

When the machine is working well to the manager's satisfaction, I would advise the marking of all cams and the spindles they work on with a centre punch, so that a check is kept on the correct alignment of these cams in case of a mishap.

Three Headaches

Now, to consider in turn the main three headaches concerned in the making of the cup, namely, the spray, profile and scrapper. (I may add that each of these is, in itself, sufficient subject for a lecture!) Although they work independently, they must be considered collectively and timed accurately to give maximum efficiency.

The correct working of the spray is of major importance. If it is not working properly it may give rise to such faults as cracked bottoms or tops, or crooked cups. It is advisable to use as small an amount of water as possible, provided that it is atomised efficiently and spraying where you want it to. It is only natural that if only a small amount of water is used, the risk of "slurrying" and dirty moulds is reduced.

The "outline" of the profile is, of course, left to the manager concerned depending on how he decides to finish off the top of the cup.

The "bevel" of the profile is, to my mind, much more important than it was even with the hand jigger. This applies both to the semi-automatic, which uses two tools (a "former" and a "finisher") and the type which uses one profile to do all the work.

In both cases it must be realised that, in so far as there is no mechanical substitute for running up by hand, the bevel of the profile must be adapted to do the job.

It is not very efficient to use 8 oz. of clay to make a 4 oz. cup, and the bevel of the profile is one of the things governing the amount of excess clay required to make a cup.

Another point which merits a good deal of thought is the actual thickness of the making profile.

All the clay which is pressed out on to the side of the profile is another waste of clay, and this can be minimised considerably by use of a wider profile.

But don't forget that in the majority of cup shapes the radius tends to decrease towards the foot.

You might finish up with a profile which, against our old principles, might be ground or filed with a hump on the bevel. Don't be afraid to experiment along these lines.

The "Tungsten-tipped" profiles are ideal for semi-automatic cup machines, especially so where the top is made by the profile.

As regards the scrapper, the choice of the type used rests with the manager concerned, as there seems to be a great variety of ideas as to which type is the most satisfactory.

Some prefer the "frog" type, using either piano wire, knitting needles, junior saw blades, sections of hack-saw blades, or specially made tungsten-tipped blades.

Another idea is to use a flexible blade or needle held only at one end, which is probably the nearest approach to hand scrapping.

The idea to go for in choosing a method of scrapping is definitely simplicity and infallibility.

There is no sense in having a scrapper which has to be attended to or continually re-set.

You must realise that, even under the best conditions as regards cleanliness and care by the operative, of (a) the machine and (b) the moulds, there will always be slight variations.

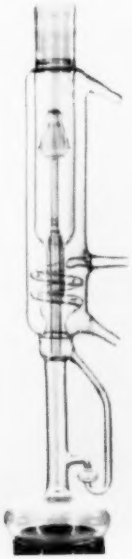
I (on a Boulton machine), use a short piece of needle about 4 in. long and have got it so weighed up that the machine can be changed from shape to shape without having to re-set the scrapper at all!

The operative either turns the needle around when it is partly worn, or replaces it with another short piece.

One half needle is good for scrapping a good 1,000 = 12's of cups!

Finally, I might say that, properly maintained and lubricated, a semi-automatic should not give any more trouble than a hand jigger and remember that any time spent studying the semi-auto is time well spent, even when it is, as you think, working properly.

(Right) A mercury vapour pump made of heat-resisting glass



The pump shown on the right was made during a demonstration on the Gas Council stand at the recent B.I.F., by Springham and Co., Ponders End, Middlesex

THE ELECTRON MICROSCOPE

by

A. E. WILLIAMS, Ph.D., F.C.S.

Probably in the phase change of clay by the action of heat lies the partial answer to the question, "What is clay?" The electron microscope is one instrument now being used in fundamental investigations in ceramic study.

THE use of the optical microscope in the examination of particles and the structure of materials is a well-established practice; but with this instrument the theoretical limit of magnification was obtained many years ago. So that with its aid one could never hope to be able to explore the finer structures of materials in which modern science is interested. This now becomes possible by the use of the electron microscope, which gives a very high degree of magnification without the use of glass lenses; its "lenses" being either magnetic or electrostatic devices. Because the resolving power of the electron microscope may be below 50 Angstrom units, it is possible for the first time to examine different types of structure, including molecules, which hitherto had been known only in theory.

In examining the structure of minerals with the aid of the electron microscope, the investigation may be done either with the aid of photomicrographs, or electron diffraction patterns; thus when required a permanent record can be kept on a photographic plate or film. The instrument is coming into use in the ceramics and refractory industries, for it is capable of indicating the change of phase which occurs in clays and other minerals when subjected to heat. Even the smallest particles of minerals that can be produced are shown up vividly by the high magnification available.

Mineral Examination

The results of the examination of a number of minerals have been recorded. In one of these tests, a sample of finely-divided white china clay was examined and the material was seen to contain hexagonal plates, mainly from 0·3 to 0·5 microns in dia., many of which were sufficiently thin to be transparent to the electron beam. The shapes of these plates were surprisingly regular and the denser aggregates—which are presumably built up from layers of the plates—also show traces of the fundamental hexagonal form. The appearance of the material is in accordance with the previously accepted theoretical structure of china clay and helps to explain some of its properties.

Attempts have also been made to secure good micrographs of American bentonite, and ultimately a suitable specimen was produced from a visually clear suspension of the mineral in water. This specimen apparently consisted of a mosaic of very thin irregularly-shaped sheets or flakes, almost transparent to the electron beam, and from 20-100 Angstrom units thick in the thinnest areas. Due to this, difficulty was experienced in obtaining a suitable micrograph, for the film of bentonite was either too thick, giving a uniform dark field; or too thin and transparent, thus giving no photograph. These features are in accordance with the well-known structure and the colloidal film-forming properties of bentonite. It is known from X-ray diffraction work that bentonite has a layer structure somewhat similar to that of china clay; but it appears

Fig. 1. Micrograph of magnesium oxide crystals; magnification 10,400 ×

from the electron microscope that the layers may be extensive in area.

In a micrograph obtained with ultramarine, the particles appear to be fairly large, from 0·6–1·0 micron, and there is distinct evidence of the presence of thin plates, some of which are hexagonal in shape, similar to particles of china clay. Ultramarine is a complex alumino-silicate which, although prepared from china clay, has a basic structure which is not layer-like, but three-dimensional and of cubic symmetry. Thus the hexagonal plates seen in a micrograph probably bear no direct relation to the crystal structure of the ultramarine. They may possibly be attributed to residual unchanged, or only partially changed, clay particles, but it is more probable that they represent layers of ultramarine which, although fully developed in structure, still retain the shape of the clay particles from which they were formed.

Some typical micrographs obtained with the Plessey electron microscope are seen in Figs. 1, 2 and 3, showing respectively magnesium oxide crystals;

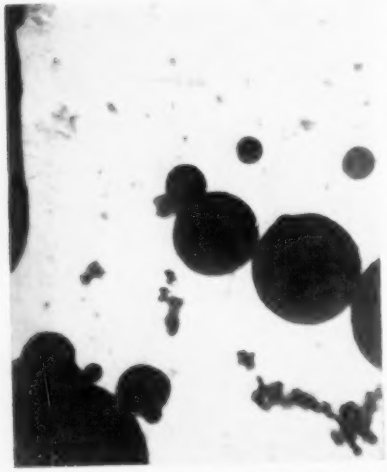


Fig. 2. Micrograph of carbonyl iron particles on plastic film, showing distribution of size and shape; magnification 8,700 ×

Fig. 3. Micrograph of aluminium oxide, showing characteristic impurities; magnification 6,000 ×

carbonyl iron particles, depicting distribution of size and shape; and aluminium oxide, showing characteristic impurities.

In applying any optical microscope to the determination of particle size, difficulty is often encountered in measuring the particles because the single particles have to be differentiated from flocculated particles, or two or more particles clinging together by reason of some impurity or other. Grain size distribution is of prime importance in many branches of the ceramics industry, and it is particularly essential to have some means of distinguishing between single unattached particles and conglomerations

of several particles. The superior magnifying power of the electron microscope permits this distinction to be made.

Although the view that the base-exchange capacity of montmorillonite is due primarily to lattice substitution and should, therefore, be relatively independent of particle size is generally accepted, a dissentient voice has been raised by A. L. Johnson (*Jour. Amer. Ceram. Soc.* 1949, 32, 210). Using estimates of particle size and particle thickness obtained by centrifuging and by the electron microscope, he calculates the area of the lateral surfaces of the plates, i.e., the surfaces normal to the a and b axes, and claims to show that the base-exchange capacity is proportional to this area and can be accounted for quantitatively by the number of broken bonds on these surfaces.

The electron microscope is a valuable adjunct in the study of particle size and the shape of the particles as a result of a particular method of grinding; while the effect of prolonged ball milling on particle size can also be studied with its aid. While counts of particles may be made while using the electron microscope, it is not normally practicable to use the result directly to extend size-distribution curves derived from optical microscopical examination. This is due chiefly to the fact that the amount of material examined at one time by the electronic instrument is very minute; so that some thousands of particles would need to be counted to produce a useful result. The instrument is applied to the investigation of the sintering and fusion of ceramic raw materials, slags and glasses. In the production of moulded goods, wherein ceramic or refractory materials are mixed with a liquid before moulding, the electron microscope is applied to the study of dispersibility of the solids in various types and strengths of liquids.

Specimen Preparation

With the optical microscope, the specimen to be viewed requires little preparation, beyond mounting on a suitable support such as a glass slide. The electron microscope, however, requires more care in specimen preparation. Many ceramic and

FURNASCOTE

Refractory Protective Coatings

FURNASCOTE REFRACTORY COATINGS represent a major development in refractory practice. It is now possible to apply to refractory bricks a coating of superior performance to that of the bricks themselves.

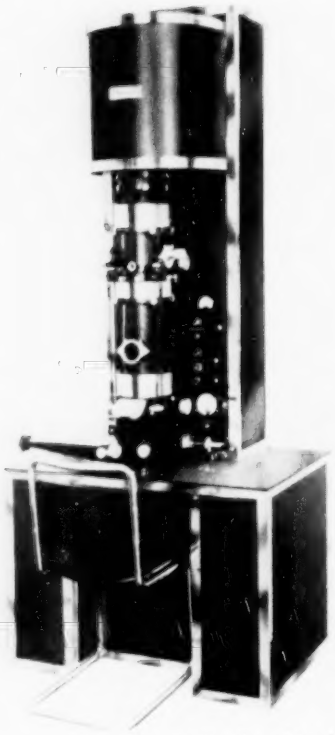
FURNASCOTE REFRACTORY COATINGS substantially lengthen the life of the underlying refractories. The necessity for rebricking, with all its high initial cost and loss of production, is greatly reduced. The sealing properties of the coatings can give substantial fuel economies.

It is hardly possible for a furnace wall to be in such a bad condition that it cannot be very considerably improved and given a long new lease of life by the application of the appropriate grade of ***FURNASCOTE.***

We invite enquiries for technical information to

CORROSION LIMITED
Warsash Road, Warsash
SOUTHAMPTON

Telephone - - Locksheath 3372



By courtesy of The Plessey Co. Ltd.

Fig. 4. The Plessey electron microscope

refractory powders require no elaborate treatment, and they are usually simply supported on a 200 mesh grid formed by etching holes approximately 0·003 in. square in copper foil. Where the specimen contains both a solid and liquid phase, the use of an electron-transparent film may be necessary, and cellulose nitrate is widely used for this purpose.

The direct examination of opaque specimens is not practicable and because of this use is made of replicas for the examination of opaque materials. The structure of the material may be revealed by the use of a suitable chemical, acting as an etching agent, on its surface. A sample treated in this way is then dipped in the plastic substance, Formvar, which is dissolved in a solvent to produce a thin viscous liquid. The sample is then allowed to dry and during this time the plastic solution sets to the contour of the specimen and acquires surface structural details of the specimen. By the aid of tweezers, the plastic may then be removed and examined in the electron microscope.

The use of a silica replica method of surface examination has also been investigated. A silica replica is obtained by chemical decomposition of silicon tetrachloride.

Typical Instruments

To some extent there is a similarity between the construction of an electron microscope and the older optical variety. The electron microscope, however, in place of light, makes use of an electron beam for illumination. Generally, two or more stages of magnification are employed, and the final beam of electrons may become visible by impact with a fluorescent screen, or it may be directed on to a photographic plate or film. In this respect the electronic unit resembles X-ray apparatus. The electron microscope may be used in so many branches of research that to combine all possible

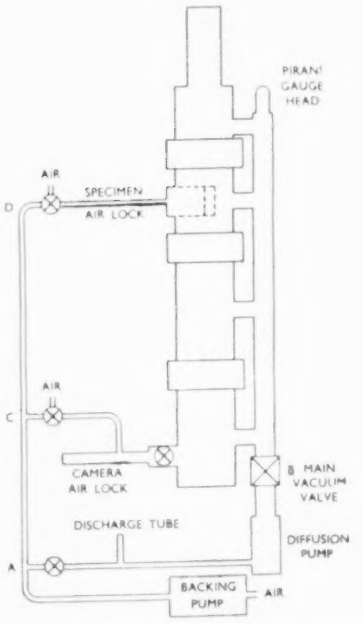


Fig. 5. Diagram of the vacuum system employed in the Plessey electron microscope

SAVED!

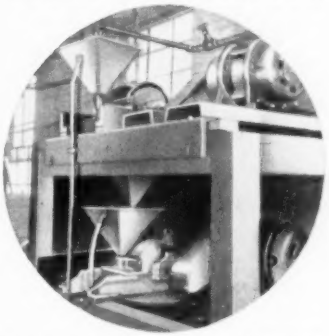
93% IN POWER...

84% IN TIME *with the*

MIKRO-PULVERISER

Leading manufacturers of pencils and crayons have applied the Wet Milling MIKRO-PULVERISER to grinding their clay-graphite and colour sludges. It has been previous practice to ball mill this sludge. In one plant the former procedure had been to run a batch of about 150 gallons in ball mills requiring a total of 25 h.p. for a period of more than 50 hours. The same finished product is produced in a Wet Milling MIKRO-PULVERISER in 8 hrs. using 10 h.p. — 1250 h.p. hrs. compared to 80 h.p. hrs.

The Wet Milling MIKRO-PULVERISER has found a considerable use in the food products field, colour and dyestuff industry, as well as for pharmaceutical ointments and the chemical, clay, cosmetic and insecticide industries. It is equally successful on both pastes and slurries. For grinding solids in suspension, or subjecting the material to an intensive mixing action — the MIKRO generally will do either, and do it better with less power. Also available for Dry Milling, our full line of MIKRO-PULVERISERS and MIKRO-ATOMISERS noted for thorough blending and precise particle control . . . grinds from granular to ultra-fine in lower micron range . . . capacities from 75 to 25,000 lbs. per hour. For complete recovery of solids and elimination of industrial dusts, investigate our MIKRO-COLLECTOR.



Two-pass Wet Milling MIKRO-PULVERISER *installation grinding clay-graphite and coloured sludges for a pencil manufacturer*

Exclusive Manufacturing Licensees for
PULVERISING MACHINERY COMPANY,
SUMMIT, NEW JERSEY, U.S.A.

BRAMIGK & CO., LTD.

MIKRO HOUSE, 15 CREECHURCH LANE, LONDON, E.C.3

'PHONE: AVENUE 4822/3 — 'GRAMS: BRAMIGK, ALD, LONDON — CABLES: BRAMIGK, LONDON

MIKRO-PULVERISER (FINE) -ATOMISER (ULTRA FINE) -COLLECTOR (INTERLOCKED)

REG. U.S. PAT. OFF.

requirements in a standard design may result in an unnecessarily complicated and expensive instrument. In addition, the continual progress in basic design and the auxiliary features needed for specialised use, have tended to make earlier designs fall rapidly out of date. Such problems are solved by the use of interchangeable units and an example of an instrument incorporating these units is the Plessey electron microscope. Fig. 4. The flexibility of its design permits special features or subsequent technical improvements to be incorporated as necessary, enabling the user to take advantage of every refinement needed for any specific job. It is a vertical two-stage, electro-magnetic instrument, operating at 50kV., and giving magnifications up to 20,000 dia. The resolving power is better than 50 Angström units, the actual resolution achieved varying with the type of specimen, in the usual manner.

Both the microscope column and the associated power supplies are built on the unit principle; the column consisting of seven units, and the power supplies of fifteen chassis connected by the "Breeze" system of cables and connectors. The uppermost part of the column is the electron gun, which is the source of electrons forming the radiation incident on the specimen. It consists of a cathode assembly and an anode block separated by a cylindrical glass tube, which serves as a vacuum wall and high voltage insulator. A corona shield over the cathode assembly houses the resistor and by-pass condenser providing bias for the gun. The earthed anode block contains an aperture and is removable for the necessary periodic cleaning in order to maintain maximum resolution.

Electron microscopes of necessity work under a high vacuum, and the vacuum system employed in the Plessey instrument is outlined in Fig. 5. It incorporates a two-stage rotary pump for backing the high-vacuum diffusion pump, and also for evacuating the air locks. Immediately above the diffusion pump and connected to it by flexible bellows rises the main pumping manifold, which continues behind the microscope column to the level of

Fig 6. The Philips electron microscope

(By courtesy of Philips Electrical Ltd.)

the condenser lens, connecting pipes being taken off to each of the main chambers. This type of construction reduces the risk of contamination of apertures by back diffusion of oil from the pump. A Pirani guage head is attached to the top of the manifold, as this is the most sensitive part of the vacuum system; too high a pressure here tending to shorten the life of the filament. At the bottom of the manifold is placed the main vacuum valve (B) which isolates the diffusion pump from the high-vacuum part of the system. This valve offers no obstruction whatever to gas flow when open, and will seal with atmospheric pressure on either side when closed. On the outlet side of the diffusion pump a conventional high-vacuum valve (A) is placed, so that by closing both valves it is possible to isolate the diffusion pump entirely while changing a pole-piece or objective aperture. Further, it is possible to keep the microscope column under vacuum when not in use, since the main vacuum valve will maintain a vacuum in the column when air is let into the pumps. This reduces the time required to obtain a high vacuum when starting up, as the system is only rarely exposed to contamination.

A further indication of the vacuum conditions is given by a discharge tube connected close to the outlet of the diffusion pump. This may be seen through a small window in the operating desk just underneath the column and is useful in tracing any leaks which may occur. Evacuation of the specimen and camera air-locks is carried out by means of the auxiliary pumping line and valves (C) and (D), while the microscope itself can also be roughly evacuated by this method.

An example of a Philips electron microscope is seen in Fig. 6. One of its special features being that it makes use of a standard 35 mm. photographic film and enables up to forty exposures to be made with one loading of the instrument. The adjustment of the illuminating field is accompanied by means of electrically-controlled magnetic deflecting fields, so making mechanical adjustment unnecessary. This instrument is of the magnetic class, incorporating five lenses, two being employed in addition to the usual condenser, objective and projector lenses. The location of the lenses gives a degree of magnification which may vary from 1,000 to 60,000 dia. Coverage of the full screen area of 8 in. at all magnifications is obtained by the use of a wide angle projector lens working at constant strength. Exact focusing is

possible without mechanical adjustment and is done through the medium of an oscillating beam focusing device. With some types of specimen it is possible to obtain photographic enlargements up to 150,000 dia., while provision is also made for producing stereo-micrographs, by the rotation of the specimen holder between two successive exposures. When an electron diffraction picture is required, a diffraction lens eliminates the necessity for removing the specimen from the object chamber to a lower chamber. By means of an adjustable diaphragm it is possible to produce an electron diffraction picture of any selected portion being examined.

The electron microscope is the only instrument yet known which is suitable for the examination of details smaller than 1,000 Angström units (4 millionths of an in.) and since its resolving power may be below even 50 Angström units, it is rapidly becoming standard for research work.

Controlled Waste Heat from Cooling Kilns by means of Louvre Damper

(SPECIALLY CONTRIBUTED)

IN recent years waste heat recovery has made great progress in the ceramic industry. The scarcity and rising cost of fuel has been a great incentive to design kilns for waste heat utilisation, and the modern type of plant lends itself better to recovery of heat, which otherwise would escape unused, than the older plant layouts and kiln designs. It is, therefore, not surprising to find in this country more or less elaborate waste heat recovery schemes either in operation, or in the course of planning. For example modern brick works utilise the waste heat from cooling kilns for drying the air in dryers. The problem is, however, that this waste heat is continuously varying due to fluctuations in firing rate, and also in atmospheric temperature. Another factor is that in most installations heat is added to the supply as additional kilns finish burning operations.

There is, however, another aspect of using automatic gear in kiln and dryer operation, which induces firms in countries where fuel is comparatively cheap, and not scarce. Saving of labour and the cost involved in employing men who more or less do nothing than to be present, and take action only very occasionally is a great incentive to use automatic

ESTABLISHED 1913

POTTERIES VENTILATING & HEATING COMPANY

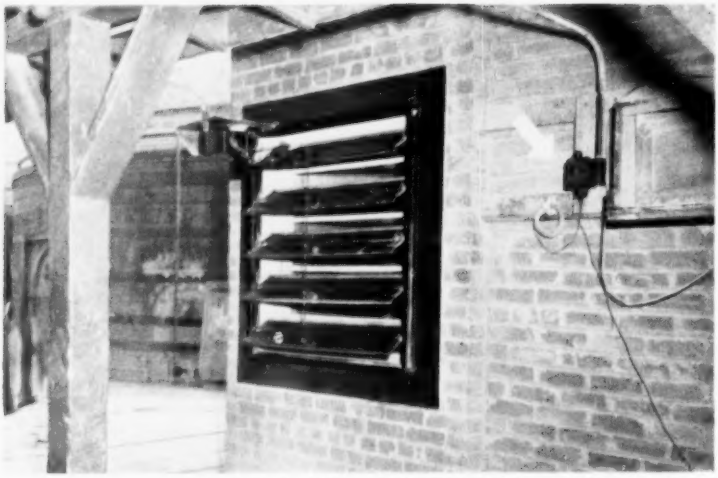
PROPRIETOR—BRITTAIN ADAMS

Dust Collecting ★ Warm Air ★ Vacuum Cleaning

Drying Heating Ventilation

TUNSTALL · STOKE-ON-TRENT

TELEPHONE STOKE-ON-TRENT 84205-6



(Courtesy, Minneapolis-Honeywell Regulator Co., Ltd., Philadelphia, U.S.A.)

Fig. 1. Automatically controlled louvre damper

control methods for kiln and dryer operation, and in waste heat recovery schemes.

The very high wages in the ceramic industry in U.S.A. makes it a paying proposition to automatise plant operation. An example is the plant of the Jenkins Brick Co., in Alabama, U.S.A. where the supervision of uniform dryer temperature took almost half the time of a man, and control by hand was not very reliable. In fact, the dryer output was hampered by inattentive setting of dampers, so that the management decided to provide thermostatic control for waste heat utilisation by comparatively simple means. An automatically controlled louvre damper (Fig. 1) was installed, consisting of a Honeywell-Brown

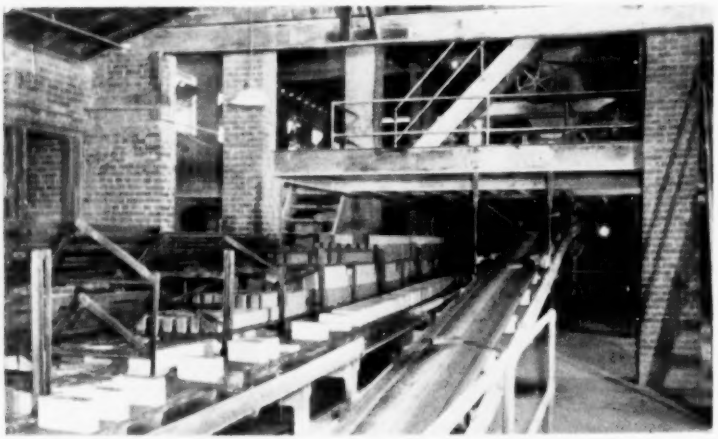


Fig. 2. Conveyor system to waste heat dryer in brickworks

Build your own equipment with

DEXION

SLOTTED ANGLE

Can be used over and over again

No drawings required—rough sketches are good enough

No drilling, welding, measuring or painting. No scrap

Just cut it and bolt it, that's all!

Phone: REGent 4841 DEXION ★ *Write or telephone for illustrated booklet* G 49
LTD., 189 REGENT ST., LONDON, W.1
TAX 4554

modulating motorised controller, and an adjustable louvre. The damper motor controls the amount of cold air admixed to the waste heat gases from the kilns. Thus the temperature of waste heat admitted to the brick dryer is kept steady, as desired and set on a thermostat. The latter is a Honeywell proportional temperature controller, as shown (see arrow), which has its remote sensing bulb installed within the dryer supply air duct. Fig. 2 shows the conveying system for the ware to and from the waste heat dryer. The control problem has been successfully solved, and works as follows. When the air supply temperature to the dryer becomes too warm, the thermostat actuates the louvre damper motor. The louvre opens gradually with temperature rise, thus admitting more cool air to mix with the warm air from the kilns. The dryer inlet air is thus kept at a constant temperature level without any attention from the man in charge of dryer operation. Actual experience has proved that with automatic temperature control a much higher percentage of first-class ware is now obtained, in addition of freeing a worker from a duty which he scarcely could perform.

The above case history story should stimulate the wider use of automatic air or gas damper control for ceramic dryers of any kind. Thermostatically controlled dampers of the louvre or butterfly type cannot only be used for correct mixture of cold and of hot air or gases for dryer inlet, as described above, but dampers can also be automatically adjusted for exhausting part of excess heat from a dryer, thus drawing in more cold air. Automatic damper motors are available which can be fitted to existing air dampers in order to eliminate the vagaries of the human element, personified in the dryer or plant operator. Where compressed air is available various pneumatic damper motors with diaphragm are obtainable.

REFERENCE

"Dryer Temperature Control Yields Better Ware." *Industrial Control News*, Philadelphia, U.S.A.

The British Ceramic Society

THE following abstracts are of papers published in the *Transactions of the British Ceramic Society*, Vol. 51, No. 5, May, 1952.

Some Possibilities of Scientific Control in the Heavy Clay Industries. by G. H. Whiting, being a communication from the Technical and Research Department, London Brick Co. Ltd.

The Fletton Industry, a comparatively recent development of brickmaking, is very favourably placed for mechanisation, mass-production and statistical control. It uses a deposit of Lower Oxford clay which outcrops right across the country, which is thick enough to be won with a high degree of mechanisation, which only requires grinding, screening and pressing to make firm green bricks, and which contains sufficient fuel to do most of the firing. Thermal economy is helped by drying and firing the bricks in the same chamber, in Hoffmann chamber kilns. Numerous borings around existing pits give a clear picture of the subsurface contours of workable clay; ceramic assessment of boring samples and face samples are a continuous help to the works, and D.T.A. and X-rays are being included in the more scientific control of the raw material. The efficiency and regularity of pans, screens and presses are well suited to investigation and improvement by a control chart technique. The operation of the kilns offers large opportunity for scientific investigation and control. The progress of drying is followed by the drying of bricks suspended in the chambers, and correlated with measurements of humidity, velocity, and temperature of drying air; details of firing procedure (a function of the volatile fuel) can be forecast by laboratory testing of the clay; design of dampers, flues, and chimneys is based on engineering principles of the flow of heat and of hot gases. By measurement, experiment, and correlation, the relative importance of various factors of kiln design can be found. An example of the use of control charts is given, and the new research laboratories are described.

The System Al_2O_3-TiO_2-SiO_2. by Y. M. Agamawi and J. White, being a communication from the Refractories Department, Sheffield University.

A preliminary investigation of the melting relationships in the ternary system was carried out by determining the cone fusion points of some sixty-seven compositions. A minimum fusion point of 1,500° C. was obtained with the composition 12·5 per cent. Al_2O_3, 22·5 per cent. TiO_2, 65 per cent. SiO_2.

In studying the thermal equilibrium diagram some forty-five mixtures were prepared and investigated by the quenching method, the equilibrium phases being identified by microscopic and X-ray examinations. On the basis of the results obtained, the thermal equilibrium diagrams of the join SiO_2—TiO_2.Al_2O_3 and of the ternary system were constructed.

The main features of these diagrams are as follows:

The join SiO_2—TiO_2.Al_2O_3 is a true conjugation line in the solidus diagram. When melting occurs it is, however, no longer a true binary join, since mullite is formed owing to overlapping of the section by the field of primary crystallisation of mullite.

The primary fields of mullite, cristobalite and TiO_2.Al_2O_3 meet at a reaction point having the composition 79·4 per cent. SiO_2, 8·2 per cent. Al_2O_3, 12·4 per cent. TiO_2, at a temperature of 1,480° C.

A ternary eutectic, at which crisobalite, rutile, TiO_2.Al_2O_3 and liquid coexist at equilibrium, occurs at 79 per cent. SiO_2, 7·5 per cent. Al_2O_3, 13·5 per cent. TiO_2 and a temperature of 1,470° C.

The locations of the phase boundaries have been established and isotherms at 1,500°, 1,550°, 1,600°, 1,650° and 1,700° C. showing the temperature distribution on the liquidus surface have been constructed.

Bunting's placing of the binary eutectic in the SiO_2—TiO_2 binary system at 10·5 per cent. TiO_2 has been confirmed by the present investigation.

The liquid contents in silica containing various proportions of TiO_2 and Al_2O_3 were calculated from the temperature-composition relations established in the ternary system. In compositions containing 98 per cent. SiO_2, least liquid formation occurs in that in which TiO_2 and Al_2O_3 are in the ratio to give TiO_2.Al_2O_3, Al_2O_3, when present alone, was found to be about twice as effective a flux as TiO_2 at temperatures higher than 1,600° C.

The effect of TiO_2 on liquid formation in fireclays of the Ayrshire bauxitic type was studied in a similar manner and it was found that the increase of liquid content due to the presence of TiO_2 up to 4 per cent. is relatively small.

PYROMETERS

for every process

by The Amalgams Co. Ltd.

SHEFFIELD 4

TEL-26581-2-3

SPEEDY ACCURATE SERVICE

ALL TYPES OF HEAT-MEASURING INSTRUMENTS SUPPLIED— REPAIRED AND CALIBRATED BY SKILLED ENGINEERS—

MINIATURE AND MULTI-POINT INDICATORS — INDICATING PYROMETERS AND CONTROLLERS—STANDARD TYPES OF THERMO-COUPLE WIRES—COMPLETE THERMO-COUPLES (in Refractory or Heat-resisting Alloy Sheaths)—COMPENSATING CABLE (Braided: Asbestos: Rubber Covered)

40 YRS.' EXPERIENCE IN TEMPERATURE MEASUREMENT & CONTROL

BOOK REVIEW

English Porcelain of the 18th Century

It is customary to look into the past for inspiration, and this is so particularly with the arts and crafts, and in this respect the ordinary products of a past age are studied with much the same awe and attention as the outstanding achievements which have come to be recognised as masterpieces of human effort. The archæologist raises from beneath the surface of the earth, in those hidden museums of the past civilisations, rare examples of glass and pottery ware, revealing the successes of early craftsmen by empirical methods, and a fine sense of artistry in the decorative finish.

However, by a shorter journey, one may find inspiration in the abundance of fine pottery and porcelain displaying the high standards reached by British craftsmen and artists in the eighteenth century. Individual potters, artists in their own right, vied with the factories in the production of pieces of exquisite taste or superb simplicity. From yeoman Worcester came sober designs showing, without shame, their underlying origin in useful husbandry. Yet pottery as a whole was tending to reflect the influence of Chelsea, which was something exotic, vivacious and capricious. In Staffordshire, still green in its rural setting, this spirit was caught up and translated through wheel and kiln into the typical eighteenth century ware.

The market for this activity was to be found amongst a wealthy merchant class, eager to discover and buy its culture for display in the expensively furnished salons of the day. They were emulating and even exceeding an aristocracy, now flaunting the quintessence of its elaborate, if moribund, way of life. Such a

capacious market encouraged art for beauty's sake with occasional flights of symmetry and fancy which compared with the pieces imported from far away China. Hence to the basic design was added elaborate decoration involving embellishments with the elemental simplicities of nature and the production of figures mounting an ascending scale of fragile finish. To the extravaganzas of Chelsea and Bow were added the dignified fineness of Worcester; spirit of gay lightness in contrast to the earlier moody Puritanism.

This movement had it repercussion on the development of the industry in meeting these demands for finer quality products and promoting a search for newer techniques at the same time as this expansion was taking place. The artist had a free rein and like the aristocratic purchaser of his works, he may have had a sense of a last fling before the "abominable factory" overtook England.

It is in these respects that the essential spirit of the period has been caught and reproduced in a book, *English Porcelain of the 18th Century*. The author, Mr. J. L. Dixon, applies himself to an appreciation of artistic merits whilst dealing with various kinds of ware, factories of origin, points of recognition, outstanding individual artists, and enlarges upon the whole by reference to the social influences which inspired the craftsman and artist to produce these fine examples of English porcelain and pottery. How many of these pieces became treasured possessions even in the humbler family, passing from one generation to another as family heirlooms, and which today are sought after for their intrinsic values by collectors all over the world.

Yet, despite what must be recognised as a predominately aristocratic influence, the accomplishments in productions of sheer beauty were a powerful contribution to the development of the industry as a whole.

It was preceded by the discovery and experiment with new materials, new kiln techniques; a movement involving artist and craftsman alike in an expansion responding to the demands for finer wares.

The industry did not enjoy a monopoly in this field, all the arts competed for the favours of the wealthy buyers, who, not content with what might be obtained in the home market, were scouring the world for art treasures of all kinds. Undoubtedly this competition inspired designers to imitate and improve upon foreign productions and the improvement was won without loss of that typically English character, which has given eighteenth century English pottery its unchallengeable recognition in the world of art.

Mr. Dixon's survey, supplied as it is with excellent illustrations, affords a comparative picture of a century which left behind it a rich heritage of design standing as an inspiration to craftsmen and designers in the succeeding years right up to our present day.

(*English Porcelain of the 18th Century*, J. L. Dixon. Faber and Faber. 30s. net.)

Personalities in the Glass Industry

IN 1951 the Society of Glass Technology privately published a book entitled "*Glass and W. E. S. Turner*". William Ernest Stephen Turner, O.B.E., D.Sc., F.R.S., is a septuagenarian, and if a man had to be selected who had contributed most to the development of the glass industry in Britain one could not think of anyone other than Turner for this privileged position.

Background

The British glass industry which had really begun in 1874 had become practically extinct by 1907: then the value of glass production was less than £5 million sterling. By 1924 it was £13 million; by 1948 it was nearly £55 million; and even allowing for the diminishment in the value of money, these figures themselves are arresting. The industry employed 38,000 operatives in 1901, 71,000 in 1950. In 1924 exports were less than 0.6 per cent. of imports, whilst in 1950 they were 2½ times the imports. The exports were worth just over £1 million in 1915 and exceeded £8 million in 1948. The industry consumed just over 300,000 tons of sand in 1916 and more than a million tons in 1950. Likewise it used 32,000 tons of soda ash in 1916 and 350,000 tons in 1950.

The point is that the glass industry grew to a very large extent in the years following 1907.

First Contact

Turner first came into contact with the industry in 1915 for, with the outbreak of World War I, Britain was auto-

matically isolated from its imported glass products from the Continent. Dr. W. E. S. Turner was a lecturer in physical chemistry at Sheffield University and it was at his suggestion that the university authorities set up an advisory department to help manufacturers to face the new conditions due to the restricted supply. Eventually the idea of a department of glass technology at Sheffield University was born and Dr. Turner ran, in double harness, both this new department and his normal lectureship in physical chemistry.

The glass technology department began in a small way in a tiny room next to the chemistry department store, and from that grew the department at the university which is known today. The glass industry in 1915 was at a very low ebb—automatic methods just did not exist. Hand workers had balloon-like cheeks and swollen paunches. All electric lamp bulbs were then hand made from pot-melted lead glass. Flat-sheet glass was just beginning to emerge from a hand cylinder process. Annealing was still an art—lehrs were low in productivity and poor in design detail. Pyrometric control hardly existed and an unsatisfactory melt was dealt with by "giving it more gas" or "adding more soda."

Industry's Reactions

The entry of Turner into the glass industry which was supremely conservative was not heralded with any fanfare of trumpets—one glass manufacturer reacted by saying: "Look at . . . . . they have a graduate on their staff and have not paid a dividend since taking him on; but we, having no such technical help have not failed to pay a dividend each year." It is the age-old story which every industry has faced when an attempt has been made to supercede the arts of black magic. In 1915 there was practically no literature on the glass industry and the Society of Glass Technology was formed late in 1916 with Dr. Turner as its secretary. However, Turner's work was not in vain for whilst the society increased in membership so the department at Sheffield grew likewise and by 1936 the manufacturers who had tended to point the finger of scorn at the scientist who was invading the industry, were by then contributing quite large sums to an expansion of the department.

International Support

The Society drew international attention and eventually, in America, with the support of the Corning Glass Co., a new department was founded at Alfred University to deal with glass technology. In Germany likewise, the universities and colleges took a similar line followed by other Continental countries including Belgium, France, Italy, Scandinavia, India, Russia, and Japan. It was not by coincidence that the Society of Glass Technology at Sheffield grew, and simultaneously the glass industry changed! The industry changed to machine production especially automatic machines to make electric lamp bulbs. It changed to fully automatic machines to make jars and bottles. The cylinder process for making sheet glass was replaced by the drawing process.

Certainly the glass industry in some 35 years has, in Britain, emerged from a state of almost complete somnolence to a stage where it can be compared, in terms of technical progress, with the other nations.

It represents a happening in technical education whereby the pure scientist in the university became the technologist and more important still, having done so, he persuaded the students who came under his jurisdiction as to the true relative position of pure science and technology—the glass industry was fortunate in having at this time a man like Professor Turner.

Since results are often the criterion of success, the reader might care to glance back on the earlier figures of British glass production and compare them with those for 1950, remembering that Professor Turner was intimately associated with both the Society of Glass Technology and the Department of Glass Technology at Sheffield from that important year, 1915.

IN INDIA AGAIN

MR. B. L. MAJUMDER took the M.Sc. degree in pure chemistry from Calcutta University in 1944 and served about 2 years in different chemical laboratories in India, joining the Ceramics Department of the North Staffs Technical College, Stoke-on-Trent, in November, 1946. He received the Undermanager's Certificate in June, 1949.

After receiving practical training in several ceramic works, he joined the British Coal Utilisation Research Association at Leatherhead, Surrey, as a research assistant and worked for 14 months on zircon and other special refractories. After leaving England in December, 1950, he joined the Bhowra Coke Co. in Manbuhm District as a furnace technologist. After passing the qualifying examinations he became an Associate Member of the Institute of Fuel. Mr. Majumder is now in charge of the control and research laboratory of the largest ceramic works in India. He has published a number of articles in CERAMICS and other British trade journals.

The American Ceramic Society

THE following are abstracts of papers appearing in the *Journal of the American Ceramic Society*, April, 1952:

The Effect of Preparation Conditions on Tensile Strength of Soda-Lime-Silica Glass Rod, by F. V. Tooley and G. F. Stockdale: A study has been made of the relationship between conditions of specimen preparation and the tensile strength of small constricted soda-lime-silica glass rods. The preparation and testing techniques were basically the same as those used in a previous investigation except that the drawing loads were systematically varied. It was found that different loads under which specimens were drawn resulted in significant changes in tensile strength values. The average strength values varied from 62,800 lb. per sq. in. to 88,400 lb. per sq. in., depending on the drawing loads used. Maximum strength values were obtained with the highest loads. The limits of error of the strength values did not change appreciably with different drawing conditions. Rubbing the specimens with the fingers reduced the strength by approximately 32 per cent.

Fused Stabilised Zirconia and Refractories, by O. J. Whittemore, Jr., and D. W. Marshall: Production of fused stabilised zirconia directly from ores in an electric arc fusion furnace is described. By this method, stabilised zirconia containing as low as 0.19 per cent. SiO_2 has been made in one furnacing from ore containing 33 per cent. SiO_2. Various properties of refractories made from fused stabilised zirconia are listed. Uses have included linings for furnaces operating to 2,500° C., setters for firing titanates, containers for steel and platinum, and resistors for oxide resistor furnaces.

Differential Thermal Analysis of Kaolin Group Minerals Under Controlled Partial Pressures of H_2O, by Robert L. Stone: Differential thermal analyses of samples of Kamee (N. C.) kaolin, Tako (Ala.) kaolin, an English kaolin, dickite (Ouray, Colo.), halloysite (Eureka, Utah), and diaspore (Chester, Mass.) were run under dynamic conditions in atmospheres containing water vapour of known partial pressures ranging from 5.0 to 760 mm. The differential thermal analysis curves of all kaolins showed the first indication of dehydration (that is, the beginning of the endothermic peak) at about 400° C., the halloysite at 320° C., the dickite at 500° C., and the diaspore at 465° C. in dry air. In steam atmosphere, the starting temperatures of the endothermic peaks were 470°, 485°, 585°, and 510° C., respectively. The peak temperatures of the endothermic peaks were only slightly affected by the atmospheres, hence the peaks were more intense and covered a narrower temperature spread in the steam atmosphere. All kaolin-group minerals showed the exothermic peak at 1,000° C. in dry air and 970°-980° C. in steam atmosphere. The data on $\ln p_{H_2O}$ vs. $1/T$ for each mineral were plotted according to the van't Hoff equation. The straight line of dickite above $\ln p_{H_2O}$ 5.30 was used to calculate the heat of dehydration. The value is 137 cal. per grm. The van't Hoff lines for the kaolinites and for diaspore, although straight lines, are in error since the recorded temperatures are considerably above the equilibrium temperatures because the rates of reaction are too slow at or near equilibrium. Actually kaolinite will decompose extremely slowly in the dry air at about 250° C., but in the steam atmosphere it will not decompose until about 475° C.

Germania Glasses; The System Na_2O-CaO-GeO_2, by N. M. Parikh and H. E. Simpson: The physical properties of some Na_2O-CaO-GeO_2 and Na_2O-CaO-SiO_2 glasses were compared. The glasses were compounded on a molecular basis with the RO held constant. Physical properties determined were softening point, viscosity, annealing point, density, and refractive index. The possible constitution of these glasses is discussed in brief on the basis of their physical properties. Their optical and transmissive properties, which were also determined, indicate possible new uses.

Comparison of Warpage, Cross-bend, Torsion, and Expansiometer Ring Tests on Titania Enamels, by James F. Lochridge and Grant E. Miller: The fit of titania enamels as determined by warpage and the expansiometer ring tests is compared to torsion and cross-bend failures. Tests were selected on the basis of normal use and acceptance by the industry. Titania enamels used for

the tests cover a wide range of warpage values from low to high compression in the enamel. The major part of the work was conducted with the normal system of ground coat and cover coat. However, some comparative results are given for enamels applied directly on a titanium-bearing steel.

It was found that warpage values and expansiometer ring values vary directly with the weight of application, and expansiometer ring values and warpage values vary inversely with weight of application, and higher warpage enamels have higher cross-bend values. Cross-bend values are lower when enamel is applied directly than when the cover coat-ground coat system is used; they are not affected by adherence variations. Torsion values in either system vary inversely with thickness, but not according to warpage, ring value, or cross bend.

THE 3M COMPANY

MINNESOTA Mining and Manufacturing Company Ltd.—3M Company—known so well under their old title, Durex Abrasives Ltd., had their new factory in Gorseinon, South Wales, opened on Saturday, 24th May, 1952, by Capt. The Rt. Hon. G. E. P. Thorneycroft, P.C., President of the Board of Trade. It is a £1,000,000 job and when in full operation—expected towards the end of the year—it will absorb some 4,500 workpeople drawn from the locality.

The President of the Board of Trade referred to the factory as part of the successful policy of development areas—he said that since the war unemployment in the Gorseinon area had been considerable but there had been a steady drop till it was now about 1·6 per cent. of the insurable population. He said that the 3M Company was "a firm which is one of the most important in the British flexible abrasives industry . . . the factory symbolised the long and successful fight against unemployment . . . last year the 3M Company accounted for 37 per cent. of the United Kingdom total trade in abrasives, whilst also last year the company were the largest United Kingdom exporters of technical abrasives."

The 3M Company began in 1902 modestly at Two Harbours, Minnesota, to develop and mine the carborundum deposit from Lake Superior—fifty years later it operates on a world-wide basis. In 1929 it was responsible for the formation of Durex Abrasives Ltd., although it was not until 1951 that 3M took full control and brought that company's name into line. Well-known products of the company are the "Scotch Boy" cellulose tapes, and at Gorseinon they have recently introduced "Underseal" rubberised protective coating for car bodies, which is finding a ready sale at home and abroad—soon a range of specialised coatings and adhesives for aircraft, motor-car and associated industries will begin. The flexible abrasive side of the business covers a vast field and, of course, coated abrasives are indispensable in the metal-working, shipbuilding, leather, glass and ceramics pottery trades. The Magnetic Recording Tape Division has gained the reputation for faithful sound reproduction.

Among the other guests at the opening luncheon was D. R. Grenfell, M.P. for Gower, who pointed out the need for modernisation in industry. He stressed that the factory symbolised new Anglo-American co-operation in Wales for it was built upon common land the title of which derived from immemorial custom and public rights.

The guests were drawn very largely from the area including public figures from the local Urban District Council and Swansea.

This 3M factory is extremely modern in design and the architects—E. R. Budgen and Partners—are to be congratulated upon the manner in which they have made the greatest possible use of natural lighting.

FUEL SAVING DEVICES

THE Minister of Fuel and Power gave the House of Commons recently, details of an experimental Government loan scheme to encourage the installation of industrial fuel saving equipment. The scheme, which will operate as an experiment, applies in approved cases to industrial firms able to save substantial amounts of fuel by installing any of a number of specified fuel saving devices: back-pressure engines and turbines, waste heat boilers, feed water economisers, air preheaters, heat exchangers and structural insulation of single sheeted factory roofs and walls.

Applications will be dealt with in order of the dates of receipt. An explanatory leaflet giving full details, and application form, may be obtained from the Fuel Efficiency Branch, Ministry of Fuel and Power, Queen Anne's Chambers, Dean Farrar Street, London, S.W.1.

FOR SALE

USED BROKEN SCOTTISH STEEL WORKS FIREBRICKS, hand cleaned, regularly for sale. Thomas Mouget & Co. Ltd., 24 Cornfield Road, Middlesbrough.

FOR SALE

KILN, new, unfired gas kiln by Askam's of Birmingham. 3 ft. by 2 ft. by 22 in. inside, semi-muffle. Complete, mint condition, with kiln furniture. £170. R. Rothery, The Grove, Halifax. Hx. 2222.

APPOINTMENT VACANT

REFRACTORY MANUFACTURERS in the North with six Intermittent Kilns, require assistant manager to take charge of setting, burning and drawing. Progressive position for first-class man. Starting salary not less than £600 per annum. Box No. 12, CERAMICS, 157 Hagden Lane, Watford, Herts.

WANTED

WANTED. Second-hand electric kiln with firing chamber 3 ft. 6 in. high, by 3 ft. by 3 ft. floor area. Height is controlling factor, other floor areas considered. The kiln must be capable of reaching a temperature of 1,150° C. Box No. 14, CERAMICS, 157 Hagden Lane, Watford, Herts.

ADVERTISERS' INDEX

Abbott, H. J.	—	International Furnace Equipment Co. Ltd.	157
Arrastraph Co. Ltd., The	—	Johnson, W. and Sons (Leeds) Ltd.	—
Attaleame Co. Ltd., The	187	Kent, James, Ltd.	151
Applied Heat Co. Ltd., The	—	Keramische Zeitschrift	173
Angel's Ltd.	118	Lafarge Aluminous Cement Co. Ltd.	—
Bark, F. W. and Co. Ltd.	175	Malkin, E. and Co. Ltd.	169
Bradley and Craven Ltd.	Cover iv	Mellor, Marmaduke, Ltd.	—
Brameck and Co. Ltd.	184	Mono Pumps Ltd.	116
British Ceramic Service Co. Ltd.	Cover iii	Podmore, W. and Sons Ltd.	—
British Wedge Wire Co. Ltd.	161	Potteries Ventilating and Heating Co. Ltd.	183
B.U. Supplies and Machinery Co. Ltd.	171	Protolite Ltd.	173
Cathercraidom Co. Ltd., The	—	Rawdon Ltd.	Cover i
Corrosion Ltd.	179	Stewarts (Hanley) Ltd.	165
Dyson, James, Burslem) Ltd.	159	Welkot Ltd.	155
Dexion Ltd.	185	Nzr (Gt. Br.) Ltd.	—
Elliott Bros. (London) Ltd.	—		
Goldsome Bros. Ltd.	Cover ii		

This is an Arrow Press Publication. Published Monthly.
Subscription Rate 25s. per annum.
Published by Arrow Press Ltd. at 157 Hagden Lane, Watford, Herts.
Telegrams: "Techpress, Watford." Telephone: Gadebrook 2308/9.

MADE AND PRINTED IN GREAT BRITAIN FOR THE PROPRIETORS, ARROW PRESS LTD., BY THE SIDNEY PRESS LIMITED, LONDON AND BEDFORD.

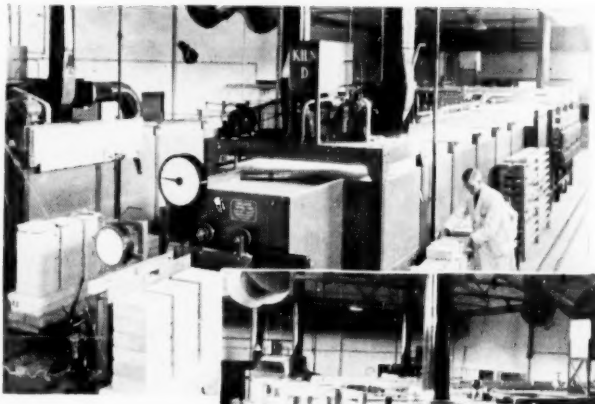
ELEVATED TEMPERATURE FIRING CYCLES

for

SPECIALISED PRODUCTS

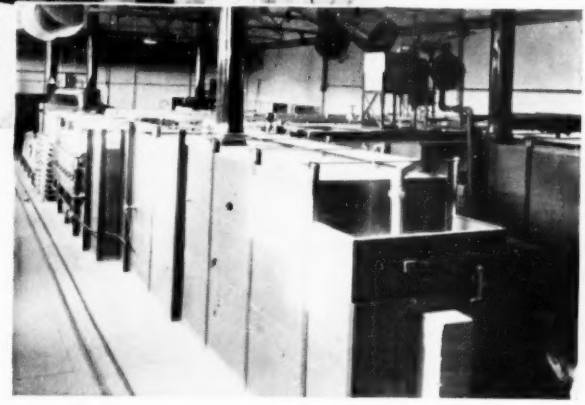
and

CERAMICS



SINTERING POWDERS AND METALS

PRODUCTS FOR RADAR, RADIO AND PROPULSION ENGINEERING



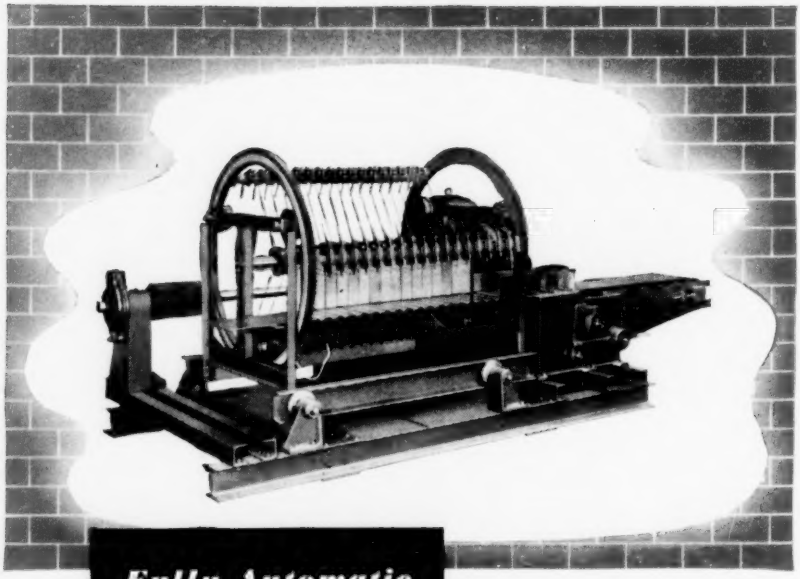
are successfully obtained in

BRICESCO TUNNEL KILNS

BRITISH CERAMIC SERVICE CO. LTD.

Bricesco House, 1 Park Avenue, Wolstanton, Stoke-on-Trent

Telegrams: Bricesco—S.O.T. Telephone: S.O.T. 87404



Fully Automatic Cutting Table

FOR CUTTING BRICKS AND HOLLOW BLOCKS

An output of 6,000 cut bricks per hour is achieved by the Bradley & Craven automatic reel type cutting table. This machine, which is powered most economically by a 5 H.P. motor operating at 720 r.p.m., has the robust construction which assures a more efficient performance and a longer working life.

Our complete range of clayworking machinery also includes grinding and tempering mills, stiff-plastic brickmaking machines, de-airing sanitary pipe machines, etc. For complete details send now for our fully illustrated catalogue.

B&C

BRADLEY & CRAVEN LTD

WAKEFIELD

Telephone : WAKEFIELD 2244 5 *Telegrams : "CRAVEN, WAKEFIELD"*

dm BC 22